

AMENDATORY SECTION (Amending Order 06-08, filed 11/21/06, effective 12/22/06)

WAC 173-160-010 What is the purpose of this regulation? (1) These regulations are adopted under chapter 18.104 RCW, to establish minimum standards for the construction and decommissioning of all wells in the state of Washington.

(2) The following are excluded from these regulations:

(a) Any excavation that is not intended to locate, divert, artificially recharge, observe, monitor, dewater, or withdraw ground water except resource protection wells, ground source heat pump borings, grounding wells, and geotechnical soil borings.

(b) Any excavation for the purpose of obtaining or prospecting for oil, natural gas, minerals, products of mining, quarrying, inserting media to repressure oil or natural gas bearing formations, storing petroleum, natural gas, or other products, as provided in chapter 78.52 RCW.

(c) ~~((Injection wells regulated in chapter 173-218 WAC.~~
Exception: ~~Injection wells used to withdraw ground water and remediation wells that are used to inject any substance to remediate, clean up, or control potential or actual contamination may be regulated by chapters 173-218 and 173-160 WAC.~~

~~((d))~~ Infiltration or exfiltration galleries, trenches, ponds, pits, and sumps, except where the department determines that the intended use of the excavation meets a definition in RCW 18.104.020.

~~((e))~~ (d) Grounding wells and grounding rods that are installed to a depth of twenty-five feet or less.

(3) Under chapter 90.48 RCW, those excavations excluded in subsection (2)(a) through (d) of this section shall be constructed, maintained, and decommissioned to ensure protection of the ground water resource and to prevent the contamination and waste of that resource.

(4) The following wells are regulated under this chapter and may be regulated under chapter 173-218 WAC: Injection wells used to dispose of water which has been withdrawn for heating or cooling purposes and remediation wells that are used to inject any substance to remediate, clean up, or control potential or actual contamination.

WAC 173-160-111 What are the definitions of specific words as used in this chapter? (1) "Abandoned well" means a well that is unmaintained or is in such disrepair that it is unusable or is a risk to public health and welfare.

(2) "Access port" is a 1/2- to 2-inch tapped hole or tube equipped with a screw cap, which provides access to the inner casing, for measurement of the depth to water surface. An access port also means a removable cap.

(3) "Annular space" is the space between the surface or outer casing and the inner casing, or the space between the wall of the drilled hole and the casing.

(4) "Aquifer" is a geologic formation, group of formations, or part of a formation capable of yielding a significant amount of ground water to wells or springs.

(5) "Artesian well" is a well tapping an aquifer bounded above and below by confining or impermeable rock or soil layers, or rock or soil layers of distinctly lower permeability than the aquifer itself. The water will rise in the well above the point of initial penetration (above the bottom of the confining or impermeable layer overlying the aquifer). This term includes both flowing and nonflowing wells.

(6) "Artificial gravel pack" is a mixture of gravel or sand placed in the annular space around the liner, perforated pipe, or well screen. A gravel pack is used to reduce the movement of finer material into the well and provide lateral support to the screen in unstable formations.

(7) "Artificial recharge" is the addition of water to an aquifer by activities of man, such as irrigation or induced infiltration from streams, or injection through wells, trenches, pits, and ponds.

(8) "Bentonite" is a mixture of swelling clay minerals, predominantly sodium montmorillonite.

(9) "Building drain" means that part of the lowest piping of a drainage system which receives the discharge from soil, waste, and other drainage pipes inside the walls of the building and conveys it to the building sewer beginning two feet outside the building wall.

(10) "Building sewer" means that part of the horizontal piping of a drainage system which extends from the end of the building drain and which receives the discharge of the building drain and conveys it to a public sewer, private sewer, individual sewage disposal system, or other point of disposal.

(11) "Capped well" is a well that is not in use and has a watertight seal or cap installed on top of the casing.

(12) "Casing" is a pipe, generally made of metal or plastic, which is installed in the bore hole as part of the drilling process to maintain the opening. Casing may be utilized in either consolidated or unconsolidated formations and must meet the requirements of WAC 173-160-201.

(13) "Confining layer" or "confining formation" means a layer of low hydraulic conductivity material that significantly limits vertical movement of ground water.

(14) "Consolidated formation" means any geologic formation in which the earth materials have become firm and cohesive through natural rock forming processes. Such rocks commonly found in Washington include basalt, granite, sandstone, shale, conglomerate, and limestone. ~~((An uncased bore hole will normally remain open in these formations.~~

~~((14))~~ (15) "Constructing a well" or "construct a well" means:
(a) Boring, digging, drilling, or excavating a well;
(b) Installing casing, sheeting, lining, or well screens, in a well;
(c) Drilling a geotechnical soil boring; ~~((or))~~
(d) Installing an environmental investigation well; or
(e) Alteration of an existing well.

~~((("Constructing a well" or "construct a well" includes the alteration of an existing well.~~

~~((15))~~ (16) "Contamination" has the meaning provided in RCW 90.48.020.

~~((16))~~ (17) "Curbing" is a liner or pipe made of concrete, precast tile or steel installed in dug wells to provide an annular space between the well bore and the liner or pipe for sealing.

~~((17))~~ (18) "Decommissioning" means to fill or plug a well so that it will not produce water, serve as a channel for movement of water or pollution, or allow the entry of pollutants into the well or aquifer(s).

~~((18))~~ (19) "Department" means the department of ecology.

~~((19))~~ (20) "Design pumping rate" means the maximum pumping rate as determined by the well driller, without exceeding the department's policy on sand and turbidity.

~~((20))~~ (21) "Dewatering well" means a cased or lined excavation or boring that is intended to withdraw or divert ground water for the purpose of facilitating construction, stabilizing a land slide, or protecting an aquifer.

~~((21))~~ (22) "Director" means director of the department of ecology.

~~((22))~~ (23) "Disinfection" or "disinfecting" is the use of chlorine, or other disinfecting agent or process approved by the department, in sufficient concentration and contact time adequate to inactivate coliform or other indicator organisms.

~~((23))~~ (24) "Domestic water supply" is any water supply which serves a family residence(s).

~~((24))~~ (25) "Draw down" is the measured difference between the static ground water level and the ground water level induced by pumping.

~~((25))~~ (26) "Drilled well" is a well in which the hole is usually excavated by mechanical means such as rotary, cable tool, or auger drilling equipment.

~~((26))~~ (27) "Drilling log" means a water or resource protection well report.

~~((27))~~ (28) "Driven well" is a well constructed by joining

a "drive point" to a length of pipe, then driving the assembly into the ground.

~~((+28+))~~ (29) "Dug well" is a well generally excavated with hand tools or by mechanical methods. The side walls may be supported by material other than standard weight steel casing.

~~((+29+))~~ (30) "Filter pack" means clean, well rounded, smooth, uniform, sand or gravel, which is placed in the annulus of the well between the bore hole wall and the liner, perforated pipe, or well screen to prevent formation material from entering the well.

~~((+30+))~~ (31) "Formation" means an assemblage of earth materials grouped together into a unit that is convenient for description or mapping.

~~((+31+))~~ (32) "Ground source heat pump boring" means a vertical boring constructed for the purpose of installing a closed loop heat exchange system for a ground source heat pump.

~~((+32+))~~ (33) "Ground water" means and includes ground waters as defined in RCW 90.44.035.

~~((+33+))~~ (34) "Grounding well" means a grounding electrode installed in the earth by the use of drilling equipment to prevent buildup of voltages that may result in undue hazards to persons or equipment. Examples are anode and cathode protection wells.

~~((+34+))~~ (35) "Grout" is a fluid mixture of cement, bentonite, and water used to seal the annular space around or between well casings, or to decommission wells.

~~((+35+))~~ (36) "Impermeable" is a descriptive term for earth materials which have a texture or structure that does not permit fluids to perceptibly move into or through its pores or interstices.

~~((+36+))~~ (37) "Liner" means a pipe inserted into a larger casing, or bore hole, after the drilling process has occurred, as a means of maintaining the structural integrity of the well. Liners may only be used in consolidated formations and must meet the requirements of WAC 173-160-201.

~~((+37+))~~ (38) "Maximum pumping rate" means the maximum pumping rate, as determined by the well driller, without exceeding the department's policy on sand and turbidity.

~~((+38+))~~ (39) "Operator" means a person who:

- (a) Is employed by a well contractor;
- (b) Is licensed under this chapter; or
- (c) Who controls, supervises, or oversees the construction of a well or who operates well construction equipment.

~~((+39+))~~ (40) "Owner" or "well owner" means the person, firm, partnership, copartnership, corporation, association, other entity, or any combination of these, who owns the property on which the well is or will be constructed or has the right to the well by means of an easement, covenant, or other enforceable legal instrument for the purpose of benefiting from the well.

~~((+40+))~~ (41) "NSF/ANSI" means the National Sanitation Foundation/American National Standards Institute.

(42) "Permeability" is a measure of the ease of which liquids or gas move through a porous material.

- (a) For water, this is usually expressed in units of

centimeters per second or feet per day. Hydraulic conductivity is a term for water permeability.

(b) Soils and synthetic liners with a water permeability of $1 \times 10^{(-7)}$ cm/sec or less may be considered impermeable.

~~((+41+))~~ (43) "Pollution" has the meaning provided in RCW 90.48.020.

~~((+42+))~~ (44) "Pressure grouting" is a method of forcing grout into specific portions of a well for sealing purposes.

~~((+43+))~~ "PTFE" means polytetrafluoroethylene casing materials such as teflon. The use of the term teflon is not an endorsement for any specific PTFE product.

~~((+44+))~~ (45) "Public water supply" is any water supply intended or used for human consumption or other domestic uses, including source, treatment, storage, transmission and distribution facilities where water is furnished to any community, collection or number of individuals, available to the public for human consumption or domestic use, excluding water supplies serving one single-family residence and a system with four or fewer connections, all of which serve residences on the same farm.

~~((+45+))~~ (46) "PVC" means polyvinyl chloride, a type of thermoplastic casing or liner.

~~((+46+))~~ (47) "Static water level" is the vertical distance from the surface of the ground to the water level in a well when the water level is not affected by withdrawal of ground water.

~~((+47+))~~ (48) "Temporary surface casing" is a length of casing (at least four inches larger in diameter than the nominal size of the permanent casing) which is temporarily installed during well construction to maintain an annular space for later placement of the surface seal as described in WAC ~~((173-160-275, 173-160-285, 173-160-305, and 173-160-315))~~ 173-160-231. The temporary surface casing shall be removed before well completion.

~~((+48+))~~ (49) "Test well" is a well (either cased or uncased), constructed to determine the quantity of water available for beneficial uses, identifying underlying rock formations (lithology), and to locate optimum zones to be screened or perforated. If a test well is constructed with the intent to withdraw water for beneficial use, it must be constructed in accordance with the minimum standards for water supply wells, otherwise they shall be constructed in accordance with the minimum standards for resource protection wells. A water right permit, preliminary permit, or temporary permit shall be obtained prior to constructing a test well unless the anticipated use of water is exempt as provided in RCW 90.44.050. A "test well" is a type of "water well."

~~((+49+))~~ (50) "Tremie tube" is a small diameter pipe used to place grout, filter pack material, or other well construction materials in a well.

~~((+50+))~~ (51) "Turbidity" means the clarity of water expressed as nephelometric turbidity units (NTU) and measured with a calibrated turbidimeter.

~~((+51+))~~ (52) "Unconsolidated formation" means any naturally occurring, loosely cemented, or poorly consolidated earth material

including such materials as uncompacted gravel, sand, silt and clay.

Alluvium, soil, and overburden are terms frequently used to describe such formations.

((+52+)) (53) "Water well" means any excavation that is constructed when the intended use of the well is for the location, diversion, artificial recharge, observation, monitoring, dewatering or withdrawal of ground water. Water wells include ground source heat pump borings and grounding wells.

((+53+)) (54) "Water well contractor" means any person, firm, partnership, copartnership, corporation, association, or other entity, licensed and bonded under chapter 18.27 RCW, engaged in the business of constructing water wells.

((+54+)) (55) "Water well report" means a document that describes how a water well, ground source heat pump, or grounding well was constructed or decommissioned and identifies components per the requirements of WAC 173-160-141.

((+55+)) (56) "Well alteration(s)" include(s): Deepening, hydrofracturing or other operations intended to increase well yields, or change the characteristics of the well. Well alteration does not include general maintenance, cleaning, sanitation, and pump replacement.

((+56+)) (57) "Well completion" means that construction has progressed to a point at which the drilling equipment has been removed from the site, or a point at which the well can be put to its intended use.

((+57+)) (58) "Well contractor" means a resource protection well contractor and water well contractor licensed and bonded under chapter 18.27 RCW.

((+58+)) (59) "Well driller(s)" or "driller(s)" is synonymous with "operator(s)."

((+59+)) (60) "Well" means water wells, resources protection wells, dewatering wells, and geotechnical soil borings. Well does not mean an excavation made for the purpose of obtaining or prospecting for oil or natural gas, geothermal resources, minerals, or products of mining, or quarrying, or for inserting media to repressure oil or natural gas bearing formations, or for storing petroleum, natural gas, or other products.

((+60+)) (61) "Well screen" means a device, usually made of plastic or metal that is capable of preventing unconsolidated or poorly consolidated geologic material from entering the well. The size of the material which is prevented from entering the well is predetermined and controlled by the screen opening or slot size of the screen. A well screen may include a riser pipe.

AMENDATORY SECTION (Amending Order 97-08, filed 3/23/98, effective 4/23/98)

WAC 173-160-121 What should I know about drilling wells that require water right permits? (1) Unless a ground water withdrawal is exempt from the permit requirements under RCW 90.44.050, a well cannot be drilled without the well owner first obtaining a water right permit from the department authorizing the use of water from the well.

(2) The licensed operator must have a copy of the water right permit or certificate on site at all times.

(3) Every well that requires a permit shall be constructed to meet the provisions of that permit. Provisions may include:

(a) Limitations on zones of completion.

(b) Special sealing requirements.

(c) Special casing and liner requirements.

(d) Other specific construction and testing details.

(4) As provided in WAC 173-548-050, no water well may be constructed for any purpose in subbasins closed in the Methow water resources regulation:

(a) Including those exempted from permitting under RCW 90.44.050;

(b) Unless written approval has been obtained from the department prior to beginning well construction.

AMENDATORY SECTION (Amending Order 97-08, filed 3/23/98, effective 4/23/98)

WAC 173-160-131 What should the well owner know about water metering? The department may require water users to measure the quantity of water withdrawn from wells, to record water use, and/or to report the water use information to the department. Until the department develops specific metering and reporting requirements, these requirements may be provided for in individual water right permits or as otherwise ordered by the department for specific wells and ground water use.

AMENDATORY SECTION (Amending Order 06-08, filed 11/21/06, effective 12/22/06)

WAC 173-160-141 What are the requirements regarding water well reports? (1) Anyone who constructs or decommissions a well is required to submit a complete report on the construction(~~(7 alteration,~~) or decommissioning of the well to the water resources

program within thirty days after completion of a well, or after the drilling equipment has left the site. The report must be an accurate summation of the data collected in the field taken from field notes written as the well was constructed or decommissioned. Field notes must be available at all times during construction or decommissioning for review by state and local inspectors and kept until the well report is submitted. Submission of a well report to consulting firms does not meet the well contractor's obligation ((of)) under this section.

(a) This applies to all water wells.

(b) The water well report must be made on a form provided by the department, or a reasonable facsimile of the form, as approved by the department.

(2) Where applicable the water well report must include, at least, the following information:

(a) Owner name; operator/trainee name; operator/trainee license number; contractor registration number, drilling company name;

(b) Tax parcel number;

(c) Well location address;

(d) Location of the well to at least 1/4, 1/4 section or smallest legal subdivision;

(e) Unique well identification tag number;

(f) Construction or decommissioning date;

(g) Start notification number;

(h) Intended use of well;

(i) The well depth, diameter, and general specifications of each well;

(j) Total depth of casing;

(k) Well head elevation;

(l) Drilling method;

(m) Seal material, seal location and type of placement used;

(n) Filter pack location; filter pack material used;

(o) The thickness and character of each bed, stratum or formation penetrated by each well, including identification of each water bearing zone;

(p) Casing gauge, diameter, stickup, type of material, and length, also of each screened interval or perforated zone in the casing;

(q) The tested capacity of each well in gallons per minute, and the test duration and draw down of the water level at the end of the capacity test;

(r) Recovery data;

(s) For each nonflowing well, the depth to the static water level, as measured below the land surface;

(t) For each flowing well, the shut-in pressure measured above the land surface, or in pounds per square inch at the land surface; and

(u) Water right permit or certificate number for all wells that are not exempt under RCW 90.44.050; and

(v) Such additional factual information as may be required by the department.

(3) The well report must ~~((show))~~ include one of the following:

(a) The license number and signature of the person who constructed or decommissioned the well.

(b) The license number and signature of the trainee and the licensed operator under chapter 18.104 RCW.

(c) The license number and signature of the exempted individual as defined under RCW 18.104.180(3).

(d) The signature of the individual exempted under RCW 18.104.180(1). ~~((If this is an unlicensed person, exempted under RCW 18.104.180(2), the report shall show the license number and signature of the licensed operator who witnessed the drilling. Water well reports for wells constructed by trainees shall have the signature and license number of the trainee and the licensed operator.))~~

(4) If a well report is missing, a new report may be generated. This report shall contain all physical components of the well and report all available information in accordance with this section. The report shall be signed by the individual collecting the physical information of the well. Submittal of this report does not relieve the person who constructed the well of their obligation to submit a complete well report under subsection (1) of this section.

(5) This rule shall allow an individual to submit electronic reports in accordance with department procedures. The use of a digital signature in the electronic report will be authorized as a substitute for an original signature under subsection (3) of this section.

AMENDATORY SECTION (Amending Order 06-08, filed 11/21/06, effective 12/22/06)

WAC 173-160-151 Does the department require prior notice and fees for well constructing, reconstructing, or decommissioning a water well? (1) Yes. The property owner, owner's agent, or water well operator shall notify the department of their intent to begin well construction ~~((, reconstruction-alteration,))~~ or decommissioning procedures at least seventy-two hours before starting work.

(2) The notice of intent is submitted on forms provided by the department and must contain the following:

(a) Well owner name;

(b) Well location; street address; county name, 1/4, 1/4 section, township, and range, and tax parcel number;

(c) Proposed use; (if the intended withdrawal requires a water right, the permit or certificate shall be attached to the notice of intent);

(d) Approximate start and completion dates;

- (e) Contractor registration number;
- (f) Operator/trainee name and license number; and
- (g) Drilling company name.

(3) In an emergency, a public health emergency, or in exceptional instances, the department may allow verbal notification to the appropriate regional office, with a notice of intent and payment of fee submitted within twenty-four hours. An emergency situation may consist of a failing well, or water quality issues which could result in a public health or safety concern.

(4) The notice must be accompanied by the following fees which apply to all newly constructed or altered wells:

(a) The fee for one water well, other than a dewatering well, with a top casing diameter of less than twelve inches is two hundred dollars. This fee does not apply to a ground source heat pump boring or a grounding well.

(b) The fee for one water well, other than a dewatering well, with a top casing diameter of twelve inches or greater is three hundred dollars.

(c) The fee for a ground source heat pump boring or a grounding well is forty dollars for construction of up to four ground source heat pump borings or grounding wells per project and ten dollars for each additional ground source heat pump boring or grounding well constructed on a project with more than four wells.

(d) The combined fee for construction and decommissioning of a dewatering well system shall be forty dollars for each two hundred horizontal lineal feet, or portion of horizontal lineal feet, of the dewatering well system.

(e) The fee to decommission a water well is fifty dollars.

(f) The fee to decommission a ground source heat pump boring or a grounding well is twenty dollars.

(5) If drilling results in an unusable well (~~((dry hole), there is))~~:

(a) A notice of intent and fee for decommissioning will apply for each unusable well;

(b) No additional notice of intent or fee to construct a water well for ((a second attempt)) each subsequent unusable well is required, provided:

((+a)) (i) A subsequent attempt at constructing a new well is made immediately; and

((+b)) (ii) The unusable well(s) is properly decommissioned before drilling equipment leaves the well site; and

((+c)) (iii) The driller follows all requirements under WAC 173-160-040(2); and

(iv) The department is notified of all decommissionings; and

((+d)) (v) A well report describing the decommissioning process is submitted to the department in accordance with this chapter.

(6) A new notice of intent and fee shall be required on all follow-up construction after the drilling equipment has left the drill site.

(7) A refund shall be made on any well that has not been constructed provided, a written request on an approved form is made

by the person who paid the fee and is submitted to the department within six months from the date the notice and fee were received by the department.

AMENDATORY SECTION (Amending Order 06-08, filed 11/21/06, effective 12/22/06)

WAC 173-160-171 What are the requirements for the location of the well site and access to the well? (1) The proposed water well shall be located (~~(on high ground that)~~) where it is not subject to ponding and is not in the floodway, except as provided in chapter 86.16 RCW.

(2) It shall be protected from a one hundred-year flood and from any surface or subsurface drainage capable of impairing the quality of the ground water supply.

(3) All wells shall not be located within certain minimum distances of known or potential sources of contamination.

(a) Some examples of sources or potential sources of contamination include:

(i) Septic systems, including proposed and reserve sites under a valid septic design: Provided, that the design has been approved for installation by a health authority;

(ii) Manure, sewage, and industrial lagoons;

(iii) Landfills;

(iv) Hazardous waste sites;

(v) Sea/salt water intrusion areas;

(vi) Chemical and petroleum storage areas;

(vii) Pipelines used to convey materials with contamination potential;

(viii) Livestock barns and livestock feed lots.

(b) Minimum set-back distances for water wells other than for public water supply are:

(i) Five feet from any existing building structure or building projection. Water wells shall not be located in garages, barns, storage buildings or dwellings. When locating a nonpublic water well adjacent to a building, the well location shall be measured from the building sewer and closest building projection.

(ii) Fifty feet from a septic tank, septic holding tank, septic containment vessel, septic pump chamber, and septic distribution box.

(iii) Fifty feet from building sewers, public sewers, collection and nonperforated sewer distribution lines except building drains.

(iv) One hundred feet from the edge of a drainfield, proposed drainfield which has been approved by a health authority, and reserve drainfield areas.

(v) One hundred feet from all other sources or potential sources of contamination except for solid waste landfills.

(vi) One thousand feet from the boundary of a permitted or previously permitted (under chapter 173-304, 173-306, 173-351, or 173-350 WAC) solid waste landfill as defined by the permit; or one thousand feet from the property boundary of other solid waste landfills. Except, a variance may be granted if documentation is provided that demonstrates the construction and operation of the well adjacent to the landfill will not further degrade the environment and will not cause a public health risk.

(c) All public water supply well(~~(s)~~) locations shall be (~~(located)~~) approved by the department of health or the local health (~~(authority)~~) jurisdiction or other department of health designee.

(i) Before construction begins, final site approval must be obtained from the department of health(~~(7)~~) or the local health (~~(authority)~~) jurisdiction.

(ii) The requirements of the state board of health regulation regarding public water supplies shall apply.

(iii) This regulation includes requirements for zones of protection, location of the well, accessibility features, and certain construction requirements.

(4) In siting a well, the driller shall consider:

(a) All local and state water well construction regulations, policies, and ordinances;

(b) Permeability of the soil or rock;

(c) Adjacent land uses;

(d) Local ground water conditions; and

(e) End use of the well.

(5) Before construction, the water well operator should strongly emphasize to the well owner, the importance of retaining good accessibility to the well to permit future inspection, maintenance, supplementary construction, and decommissioning.

AMENDATORY SECTION (Amending Order 06-08, filed 11/21/06, effective 12/22/06)

WAC 173-160-191 What are the design and construction requirements for completing wells? (1) You may complete wells with screens, perforated liners or pipe, or open bottom completion. The well driller or designer shall advise the owner or the owner's representative of the most appropriate method of completion.

(2) All well components must be of sufficient strength to withstand the (~~(normal)~~) typical forces to which they are subjected during and after construction.

(3) Water wells must be completed in a manner which prevents the production of untreatable amounts of sand, silt, or turbid water which would render the well unusable.

(4) Open bottom completion is appropriate where the withdrawn waters are essentially free of sand, silt and turbidity.

(5) Perforated pipe completion is suitable for a coarse-grained, permeable aquifer where the withdrawn waters are free of sand, silt or turbidity.

(6) Perforations above the static water level are not permitted.

(7) In place perforations with Star, Mills knife, or similar type perforators are acceptable.

(8) Perforated pipe liners, either saw cut, torch cut, mill slotted, or punched are acceptable.

(9) The use of perforated casing for working casing as the hole is being drilled is prohibited, except in those cases where the contractor can, through personal experience in the particular area of drilling, attest to the sufficiency of the pre-perforated casing in all respects for the specific well being constructed.

(10) Pipe liners may be of steel, plastic or other suitable corrosion resistant material.

(11) All liners must be of sufficient strength to withstand (~~normal~~) typical forces exerted upon the liner material during installation and operation.

(12) Liners may be used only in consolidated formations.

(13) The installation of a liner without a gravel pack is prohibited when conditions exist that will result in excessively turbid water.

(14) Well screens and well points must be constructed of compatible corrosion resistant material.

(a) A neoprene, or grout seal shall be fitted to the top of the well screen assembly, if necessary.

(b) The bottom of the well screen shall be plugged or capped.

(c) The use of lead packers is prohibited.

(15) The alignment of the bore hole, permanent casing, or liner shall be sufficiently plumb and straight to allow the installation of screens, liners, pumps, and pump columns without binding or having adverse affects on the operation of the installed pumping equipment.

(a) Alignment of the well casing or bore hole shall not deviate from an alignment that would allow a twenty foot test section of pipe to be inserted to the bottom of the well without binding.

(b) The diameter of the test section of pipe shall be per Table 1 in WAC 173-160-201.

(c) For testing alignment in casing reductions, each section shall be tested separately.

(16) For wells completed in an unconsolidated formation in which the bore hole extends beyond the completed casing or screen depth, the driller must backfill that portion of the bore hole that extends more than ten feet beyond the casing or screen. The backfill shall consist of either bentonite or chlorinated sand or pea gravel. If any portion of the bore hole extension penetrates a clay layer which is greater than six feet in thickness, that portion of the bore hole shall be sealed with bentonite. A notice of intent to decommission a water well is not required for this work.

AMENDATORY SECTION (Amending Order 06-08, filed 11/21/06, effective 12/22/06)

WAC 173-160-201 What are the casing and liner requirements?

(1) Proper casing must be installed in all water supply wells.

(2) The casing shall withstand (~~(normal)~~) typical forces which act upon it during and after installation. It shall be resistant to the corrosive effects of the surrounding formations, earth, and water and shall be impervious to any contaminants encountered.

(3) All plastic casing or liner pipe used in potable water supply wells must be manufactured to conform to National Sanitation Foundation (NSF) Standard 14-84, or the most recent revision.

(4) Unless prior approval is obtained from the department, well casings and liner pipes must be made of either steel or plastic.

(5) Liner pipe must be of sufficient strength to withstand breakage or collapse when the well is pumped and meet ASTM potable water standards.

(6) When installed, liner pipe shall extend or telescope at least two feet into the lower end of the well casing. If more than one string of liner pipe is installed, each string shall extend or telescope at least eight feet into the adjacent larger diameter liner pipe.

(7) Liner pipe may not be permanently fixed to a well casing below land surface.

(8) Minimum specifications for steel casing and steel liner pipe for water wells are shown in Table 1.

~~((9) Minimum specifications for plastic casing and plastic liner pipe for water wells are shown in Table 2.~~

~~((10) Steel casing larger than twenty inches shall have a minimum wall thickness of 0.375 inches.))~~

TABLE 1
Minimum Specifications for Steel Casing and Steel Liner Pipe

NOMINAL SIZE (inches)	OUTSIDE DIAMETER (inches)	WALL THICKNESS (inches)	WEIGHT PER FOOT (pounds)	TEST SECTION OUTSIDE DIAMETER (inches)
1.25	1.660	0.140	2.27	0.500
1.5	1.900	0.145	2.72	0.750
2.0	2.375	0.154	3.65	1.000
2.5	2.875	0.203	5.79	1.500
3.0	3.500	0.216	7.58	2.000
3.5	4.000	0.226	9.11	2.500
4.0	4.500	0.237	10.79	3.000
5.0	5.563	0.258	14.62	3.500
6.0	6.625	0.250	17.02	4.000

NOMINAL SIZE (inches)	OUTSIDE DIAMETER (inches)	WALL THICKNESS (inches)	WEIGHT PER FOOT (pounds)	TEST SECTION OUTSIDE DIAMETER (inches)
8.0	8.625	0.250	22.36	6.000
10	10.750	0.250	28.04	8.000
12	12.750	0.250	33.38	10.000
14	14.000	0.312	45.61	11.000
16	16.000	0.375	57.52	14.000
18	18.000	0.375	70.59	16.000
20	20.000	0.375	78.60	18.000
24	24.000	0.375	94.62	20.000
30	30.000	0.375	118.65	24.000

(9) Steel casing larger than thirty inches shall have a minimum wall thickness of 0.375 inches.

(10) Minimum specifications for plastic casing and plastic liner pipe for water wells are shown in Table 2.

TABLE 2
Minimum Specifications for Plastic Casing and Plastic Liner Pipe

NOMINAL CASING DIAMETER (inches)	MINIMUM THICKNESS (inches)	SDR
2.0	0.133	21
2.5	0.137	21
3.0	0.167	21
3.5	0.190	21
4.0	0.214	21
4.5	0.236	21
5.0	0.265	21
6.0	0.316	21
8.0	0.410	21
10	0.511	21
12	0.606	21

~~((STEEL CASING AND STEEL LINER))~~

(11) Steel casing and steel liner: All steel casing and steel liner must be new or, in like new condition, and be structurally sound.

(a) Casing or liner that has been exposed to a contaminant shall not be used in well construction unless the contamination can be entirely removed.

(b) When casing or liner lengths are joined together, they must be connected by watertight weld or screw coupled joints.

(i) Welded joints must be at least as thick as the wall thickness of the well casing and be fully penetrating.

(ii) All steel well casing or liner shall meet or exceed the minimum American Society for Testing and Materials (ASTM) A-53 A or B specification for steel pipe.

~~((PLASTIC CASING AND PLASTIC LINER))~~

(12) Plastic casing and plastic liner: Plastic, fiberglass, PVC, SR, ABS, CPVC or other type of nonmetallic well casing or liner must be manufactured and installed to conform with ANSI/ASTM F 480-81, or the most recent revision.

(a) SDR is calculated by dividing the outside diameter of the pipe by the wall thickness.

(b) SDR 21 is the minimum requirement (Class 200); higher pressure rated pipe may be used.

(c) All plastic casing must be installed only in an oversized drill hole without driving. The oversized hole must be a diameter of at least ((4)) four inches larger than the outside diameter of the plastic casing or coupling hubs, whichever is larger. Plastic casing and liner must be of sufficient strength to withstand breakage or collapse when installed and while the well is pumped. Plastic casing and liner must meet ASTM potable water standards.

(d) All plastic casing or liner must be new or, in like new condition and clearly marked by the manufacturer showing nominal size, class, type of plastic material, SDR, ASTM designation, and have a ((~~National Sanitation Foundation~~)) NSF((+)) seal of approval for use in potable water supplies.

(e) Casing or liner that has been exposed to a contaminant shall not be used in well construction unless the contaminant is entirely removed.

(f) Plastic casing or liner joints must be watertight.

(i) Either "bell" type, threaded joints, or coupling hubs are approved.

(ii) Hub couplings must be of materials meeting the specifications for plastic casings as stipulated in subsection (2) of this section.

(iii) If joints are secured with solvent cement, it must be done in accordance with manufacturer's directions.

((~~CONCRETE CURBING~~))

(13) Concrete curbing: The concrete used to make curbing must consist of clean, hard and durable aggregate with not less than five sacks (ninety-four pounds per sack) of portland cement per cubic yard of concrete.

(a) The maximum diameter of aggregate particles may not exceed 1 1/2 inches, but in any case may not exceed 1/5 the minimum width of the casing thickness.

(b) The ratio of coarse aggregate to fine aggregate (passing No. 4 U.S. Standard Sieve) must be approximately 1 1/2 to 1 by volume, but in any case, may not exceed 2 to 1 nor be less than 1 to 2.

(14) The curbing shall be at least six inches thick and free of voids. The walls shall be poured in one continuous operation.

(15) When concrete tile is used to line a well, the combined total wall thickness and seal shall be a minimum of six inches.

NEW SECTION

WAC 173-160-214 What are the limitations for use of drilling materials? (1) At no time shall a product contain materials that:

- (a) Are toxic or polluting;
- (b) Develop odor or color changes in the water; or
- (c) Serve as a microbial nutrient.

(2) Organic materials which foster or promote undesired organic growth or have the potential to degrade water quality shall not be employed in the construction of a water supply well. This includes, but is not limited to, brans, hulls, grains, starches, and proteins, unless NSF/ANSI approved.

NEW SECTION

WAC 173-160-216 What are the standards for use of polymers and additives? (1) All polymers and additives used in any well shall be certified by NSF/ANSI approval standards for use in potable water supply wells, or equivalent standards as approved by the department. The product shall be clearly labeled as meeting these standards.

(2) Polymers and additives must be designed and manufactured to meet industry standards to be nondegrading and must not act as a medium which will promote growth of microorganisms.

AMENDATORY SECTION (Amending Order 06-08, filed 11/21/06, effective 12/22/06)

WAC 173-160-221 What are the standards for sealing materials?

(1) **Bentonite sealant:**

(a) Bentonite used to prepare slurries for sealing((7)) or decommissioning shall be specifically designed for this purpose. ((At no time shall grout slurry contain materials that are toxic, polluting, develop odor or color changes, or serve as a micro-bacterial nutrient.)) All bentonite slurries shall be prepared and installed according to the manufacturer's instructions. ((All additives must be certified by a recognized certification authority such as NSF.)) Active solids content (bentonite) shall be twenty percent by weight or greater in all bentonite slurries. The active solids shall be checked by using the following formula:

((~~Weight of bentonite (lbs.)~~ X 100 = % solids
~~Weight of bentonite (lbs.) + (gallons of water x 8.33 lbs./gal)~~

((~~Example: 105 lbs. of bentonite~~ X 100 = 20% solids

$$\frac{105 \text{ lbs. bentonite} + (50 \text{ gallons of water} \times 8.33 \text{ lbs./gal.})}{\text{Weight of bentonite (lbs.)} + (\text{gallons of water} \times 8.33 \frac{\text{lbs.}}{\text{gal.}})} \times 100 = \% \text{ solids}$$

Example:

$$\frac{50 \text{ lbs. of bentonite}}{50 \text{ lbs. of bentonite} + (24 \text{ gallons of water} \times 8.33 \frac{\text{lbs.}}{\text{gal.}})} \times 100 = 20\% \text{ solids}$$

(b) Unhydrated bentonite(~~(--)~~) including pelletized, granulated, powder, or chip bentonite may be used in the construction of seals or in decommissioning of wells. The bentonite material shall be specifically designed for sealing or decommissioning and be within the industry tolerances for dry western sodium bentonite. (~~(Polymer additives must be designed and manufactured to meet industry standards to be nondegrading and must not act as a medium which will promote growth of micro-organisms. All unhydrated bentonite used for sealing or decommissioning must be free of organic polymers.)~~) Placement of bentonite shall conform to the manufacturer's specifications and result in a seal free of voids or bridges.

(c) All bentonite used in any well shall be certified by NSF/ANSI approval standards for use in potable water supply wells, or equivalent standards as approved by the department. The product shall be clearly labeled as meeting these standards.

(2) Cement sealants:

(a) Neat cement consists of either portland cement types I, II, III, or high-alumina cement mixed with not more than six gallons of potable water per sack of cement (ninety-four pounds per sack).

(b) Neat cement grout consists of neat cement with up to five percent bentonite clay added, by dry weight of the bentonite. Bentonite is added to improve flow qualities and compensate for shrinkage.

(c) Concrete sealants consist of clean, hard and durable aggregate with not less than five sacks (ninety-four pounds per sack) of portland cement per cubic yard of concrete sealant and water.

(i) The maximum diameter of aggregate particles may not exceed 1 1/2 inches, but in any case may not exceed 1/5 the minimum width of the casing thickness.

(ii) The ratio of coarse aggregate to fine aggregate (passing No. 4 U.S. Standard Sieve) must be approximately 1 1/2 to 1 by volume, but in any case, may not exceed 2 to 1 nor be less than 1

to 2.

(iii) The quantity of water used for each batch of cement sealant shall not exceed manufacturer's recommendation.

(d) Expanding agents, such as aluminum powder, may be used at a rate not exceeding 0.075 ounce (1 level teaspoon) per sack (ninety-four pounds per sack) of dry cement. The powder may not contain polishing agents. High-alumina cement and portland cement of any type must not be mixed together.

(e) Controlled density fill (CDF) or fly ash shall not be used in any well construction or decommissioning.

(f) All cement sealants shall be mechanically mixed prior to placing in the well or bore hole.

(3) **Sealing methods:**

(a) When neat cement or neat cement grout is used in sealing, it shall be placed seventy-two hours before additional drilling takes place, unless special additives are mixed with the neat cement or neat cement grout that cause it to set in a shorter period of time.

(b) All hydrated sealing materials shall be placed by ~~((tremmying))~~ tremmying the mixture from the bottom of the annular space to the surface in one continuous operation.

(4) This section may not preclude the use of new sealant materials which have been approved by the technical advisory group.

(5) Sealing materials shall be impervious to any contaminants encountered.

AMENDATORY SECTION (Amending Order 06-08, filed 11/21/06, effective 12/22/06)

WAC 173-160-231 What are the standards for surface seals?

(1) All water wells constructed shall have a surface seal which seals the annular space between the bore hole and the permanent surface casing.

(a) The seal shall be constructed to prevent surface contaminants from reaching the ground water.

(b) The surface seal must have a minimum diameter of four inches larger than the nominal size of the surface casing, to include the outside diameter of the bell, in bell and hub couplings.

(c) The surface seal must extend from land surface to a minimum depth of eighteen feet. Except, when the minimum surface seal requirements for driven, jetted, dewatering and some dug wells are less than eighteen feet. See the appropriate section for these wells for a detailed description of their sealing requirements.

(2) Sealing material must be placed in an open annular space that is a minimum of four inches greater in diameter than the nominal size of the permanent casing. The annular space must be kept at least one-half full of sealing material whenever the

production casing is advanced.

(3) The completed surface seal must fully surround the permanent casing, must be evenly distributed, free of voids, and extend to undisturbed or recompacted soil.

(4) After the permanent casing has been set in final position, the annular space shall be filled to land surface with bentonite or neat cement grout or neat cement. Leaving voids for future installation of equipment such as a pitless adapter is prohibited.

(5) A temporary surface casing with a minimum length of eighteen feet and a minimum nominal diameter of four inches greater than the permanent casing shall be used in all unconsolidated formations such as in gravels, sands, or other unstable conditions when the use of drilling fluid or other means of keeping the bore hole open are not employed. Except driven and jetted wells shall utilize a temporary surface casing with a minimum length of six feet and a minimum nominal diameter of four inches greater than the permanent casing shall be used in all unconsolidated formations such as in gravels, sands, or other unstable conditions when the use of drilling fluid or other means of keeping the bore hole open are not employed.

(6) Whenever reconstruction involves permanent surface casing movement; or the existing surface seal is damaged; or a surface seal never existed; the driller shall repair, replace, or install a minimum of eighteen feet of surface seal around the permanent casing.

AMENDATORY SECTION (Amending Order 06-08, filed 11/21/06, effective 12/22/06)

WAC 173-160-241 What are the requirements for formation sealing?

(1) Unconsolidated formation sealing - Without significant clay beds or other confining formations - Drilled wells that penetrate an aquifer overlain by unconsolidated formations such as sand and gravel without significant clay beds (at least six feet thick) or other confining formations shall be sealed in accordance with the surface sealing requirements of WAC 173-160-231. See Figure 1.

(2) Unconsolidated formation sealing - With significant clay beds or other significant confining formations - Drilled wells that penetrate an aquifer overlain by clay or other confining formations that are at least six feet thick, shall be sealed to prevent movement of water or contamination in the annular space between the permanent casing and the clay or other confining formation(s). One of the following methods shall be used to seal the annular space:

(a) A drill hole at least four inches greater in diameter than the nominal size of the permanent well casing shall extend from the land surface into the clay bed or other confining formation located directly above the aquifer to be developed. The annular space

shall be filled with bentonite (slurry or unhydrated), neat cement grout, or neat cement to form a watertight seal between the permanent casing and all significant confining formations encountered during drilling. If bentonite slurry, neat cement grout, or neat cement is used to seal the annular space it must be placed by either pumping or (~~tremmying~~) tremying the seal material from the lowest clay bed or other confining formation of significance encountered, to land surface. The drill hole shall be kept open through the use of a temporary casing or any other drilling method that stabilizes the bore hole wall. See Figure 1.

(b) An upper drill hole at least four inches greater in diameter than the nominal size of the permanent well casing shall extend to a minimum of eighteen feet from land surface. A temporary casing or other means of maintaining an open bore hole shall be utilized. All temporary casing will have an outside diameter of a minimum of four inches larger than the permanent casing (for example, a ten-inch temporary casing for a six-inch permanent casing). The upper drill hole shall always contain a minimum of nine feet of sealant throughout the advancement of the permanent casing. Except, if the temporary casing is removed or not utilized, the upper drill hole shall be kept full of sealant. See Figure 1.

(3) Consolidated formations - In drilled wells that penetrate an aquifer, either within or overlain by a consolidated formation, sealing of the casing shall conform with one of the following procedures.

(a) Procedure one - An upper drill hole at least four inches greater in diameter than the nominal size of the permanent well casing shall extend from land surface into a sound, unfractured, consolidated formation. An unperforated permanent casing shall be installed to extend to this same depth, and the lower part of the casing shall be driven into the consolidated formation and sealed in a manner that establishes a watertight seal between the formation and the casing. The remainder of the annular space to land surface shall be filled with neat cement grout, neat cement, or bentonite.

(i) If the consolidated formation is encountered at a depth less than eighteen feet from land surface, the upper drill hole and permanent casing shall extend to a minimum of eighteen feet from land surface. See Figure 2.

(ii) If neat cement grout, neat cement, or bentonite slurry is placed by pumping to seal the entire annulus from the bottom up to land surface, the upper drill hole may be a minimum of two inches larger than the outside diameter of the permanent casing.

(b) Procedure two - An upper drill hole at least four inches greater in diameter than the nominal size of the permanent casing extends from land surface to a depth of at least eighteen feet. An unperforated permanent casing shall be driven into the consolidated formation and sealed in a manner that establishes a watertight seal between the formation and the casing. Throughout the driving of the well casing to the consolidated formation, the annular space between the upper drill hole and the permanent casing shall be kept

at least one-half full with unhydrated bentonite, or bentonite slurry. The remainder of the annular space to land surface shall be filled with cement grout, neat cement, or bentonite. See Figure 2.

(c) If temporary surface casing is used in either procedure (a) or (b) of this subsection, the casing must be a minimum of eighteen feet long and at least four inches larger in diameter than the permanent casing. If a consolidated formation is encountered within the first eighteen feet, the temporary casing may terminate at the interface of the consolidated formation. Withdrawal of the temporary casing must take place simultaneously with proper sealing of the annular space to land surface.

AMENDATORY SECTION (Amending Order 06-08, filed 11/21/06, effective 12/22/06)

WAC 173-160-261 How do I seal dug wells? The surface seal of all dug wells shall be constructed to effectively seal the annular space between the undisturbed native material of the upper well hole and the well curbing, which may consist of ((†)) concrete tile, steel pipe or liner((†)). The seal depth shall be at least eighteen feet from land surface or to within three feet of the bottom in dug wells that are less than twenty-one feet in depth. Dug wells may be sealed with cement, neat cement, bentonite, or neat cement grout. A cap shall be placed on all dug wells. Except during maintenance, the cap shall remain in place. The cap shall prevent entry of pollutants, insects, and mammals into the well. See Figure 3.

AMENDATORY SECTION (Amending Order 97-08, filed 3/23/98, effective 4/23/98)

WAC 173-160-281 What are the construction standards for artificial gravel-packed wells? Wells must be constructed in accordance with sealing standards under this chapter. In gravel-packed wells, the gravel mixture shall be placed around the screen so that bridging or size separation does not occur. The gravel pack must be clean, and chemically stable. All gravel and water used must be disinfected with at least fifty parts per million ((ppm)) chlorine for a contact time of at least thirty minutes. Rinse water containing chlorine is a pollutant. Chlorine in the rinse water must be allowed to dissipate and the water must be discharged in a safe manner consistent with the intent of the Water Pollution Control Act, chapter 90.48 RCW. ((See Figure 5.))

AMENDATORY SECTION (Amending Order 06-08, filed 11/21/06, effective 12/22/06)

WAC 173-160-291 What are the standards for the upper terminal of water wells? (1) The watertight casing or curbing of any well shall extend at least six inches above the ground surface. Pit completion is prohibited.

(2) Where the site is subject to flooding, the top of the casing must be at least two feet above the estimated water level of a one hundred-year frequency flood.

(3) All drilled wells shall be capped to prevent contamination of the aquifer. The cap shall be designed for that purpose and consist of metal or plastic material that is mechanically secured or welded to the casing. All wells shall be equipped with an access port that allows for the measurement of the depth to water surface, or with a pressure gage that indicates the shut-in pressure of a flowing artesian well. See Figure 6. The access ports and pressure gages or other openings in the cover are sealed or capped to prevent entrance of surface water or foreign material into the well.

(4) Any vent opening, observation ports or air-line equipment shall extend from the upper end of the well by watertight piping to a point at least six inches above land surface. The terminals of these facilities shall be shielded or sealed to prevent entrance of foreign matter or pollutants.

(5) A pitless adapter, or similar device is permitted on water wells if it is made with fittings approved by the department of health. The use and installation of pitless adapters must meet manufacturer's standards. The connection must be above static water level except for adapters specifically designed for installation below static water level.

(6) Any person who removes any part of a surface seal to install a pitless adapter shall be responsible to have the seal repaired by a licensed or otherwise qualified person so that the seal is brought up to land surface.

AMENDATORY SECTION (Amending Order 06-08, filed 11/21/06, effective 12/22/06)

WAC 173-160-311 What are the well tagging requirements? (1) It shall be the operator's responsibility to place a well identification tag with a unique identification number on every well that they construct, alter, or reconstruct within thirty days

of completion of the well. The original unique identification number shall be used on all subsequent work and documentation.

(a) The alpha-numeric number shall be recorded on the drilling report in the space provided.

(b) The operator shall remove the well identification tag on all wells they decommission and shall attach the tag to the decommissioning well report.

(2) It shall be the well owner's responsibility to place a well identification tag with a unique identification number on every well they own, unless the well has been previously tagged.

(a) Upon request, the department shall furnish the well owner with a well tag and tagging instructions.

(b) The well owner shall tag their well(s) and submit a completed tagging report to the department.

(3) The well tag shall be permanently attached to the outer well casing or other prominent well feature and be visible above land surface.

(4) All well identification tags shall be supplied by the department.

(5) It is unlawful for a person to tamper with or remove a well identification tag except during well alteration.

AMENDATORY SECTION (Amending Order 06-16, filed 2/22/07, effective 3/25/07)

WAC 173-160-381 What are the standards for decommissioning a well? Any well which is unusable, abandoned, or whose use has been permanently discontinued, or which is in such disrepair that its continued use is impractical or is an environmental, safety or public health hazard shall be decommissioned. The decommissioning procedure (as prescribed by these regulations) must be recorded and reported as required by the department.

(1) Cased wells. Remove all liners, debris, accumulated sediments, and obstructions from the well casing, except well screens and packers. All cased water wells, including driven and jetted wells shall be decommissioned in one of the following ways:

(a) Perforate the casing from the bottom to within five feet of the land surface and pressure seal the casing.

(i) Perforations shall be at least four equidistant cuts per row, and one row per foot. The perforations must be sufficient enough to allow neat cement grout or neat cement, or bentonite slurry to migrate outside the casing and effectively prevent the movement of water.

(ii) Apply enough pressure to force the sealing material through the perforations, filling any voids on the outside of the casing.

(iii) The casing shall be filled completely with neat cement grout, neat cement, or bentonite slurry. The screen and up to five

feet of riser pipe may be filled with unhydrated bentonite. The remainder of the riser pipe must be removed.

(iv) The casing may be cut off at a maximum of five feet below land surface(~~((. A steel cap shall be welded on the casing))~~); or

(b) Withdraw the casing and fill the bore hole with concrete, neat cement grout, neat cement, unhydrated bentonite, or bentonite slurry as the casing is being withdrawn.

(2) Uncased wells - Remove all liners, debris, accumulated sediments, and obstructions. Seal uncased wells with concrete, neat cement grout, neat cement, or bentonite.

(3) Dug wells -

(a) The following criteria are required for the decommissioning of all dug wells:

(i) Remove all debris, accumulated sediments, and obstructions that impede decommissioning or that may contaminate the aquifer from within the dug well.

(ii) Dug wells may have a maximum of three feet of soil cover from top of sealing material to land surface.

(iii) Dug wells shall be sealed with either unhydrated bentonite, neat cement, neat cement grout, or concrete. The use of controlled density fill (CDF), bentonite slurry, or fly ash is prohibited.

(iv) Dug wells that are not cast-in-place must have a minimum of three feet of sealing material in contact with native soil below land surface. (~~((Bentonite slurry shall not be used to decommission dug wells.))~~)

(b) Dug wells (~~((that are dry at any time during the year and that are less than twenty feet in depth shall be sealed from the bottom to within three feet of land surface.~~

~~((c) Dug wells that have a))~~ less than twenty feet deep.

((i) Dry wells (dry at any time during the year). Decommission by placing unhydrated bentonite, neat cement, neat cement grout or concrete from the bottom to within three feet of land surface.

((ii) Static water level ((of)) ten feet or less from land surface ((or less and a depth of less than twenty feet may be decommissioned)). Decommission by ((installing)) placing clean chlorinated sand or pea gravel to a maximum depth of ten feet below land surface. The remainder of the well shall be filled with ((either)) unhydrated bentonite, neat cement, neat cement grout, or concrete to within three feet of land surface.

((((d) Dug wells that have a)) ((iii) Static water level ((over)) of greater than ten feet ((and a depth of less than twenty feet from land surface may be decommissioned)) from land surface. Decommission by ((installing)) placing clean chlorinated sand or pea gravel to the static level. The remainder of the well shall be filled with ((either)) unhydrated bentonite, neat cement, neat cement grout, or ((cement)) concrete to within three feet of land surface.

((((e)) (c) Dug wells ((with static levels)) twenty feet or ((less)) greater in depth.

((i) Static water level twenty feet or less from the land surface ((and that are greater than twenty feet deep may be

~~decommissioned)).~~ Decommission by placing chlorinated sand or pea gravel to twenty feet below land surface. The remainder of the well(~~((, to a maximum of three feet below land surface,))~~) shall be filled with unhydrated bentonite, neat cement, neat cement grout, or concrete to within three feet of land surface.

~~((f) Dug wells with))~~ (ii) Static water level((s below)) greater than twenty feet from land surface(~~((7))~~). These wells may be decommissioned by placing chlorinated sand or pea gravel to the static level and then placing alternating layers of sealing material and chlorinated sand or pea gravel to within twenty feet of land surface. The alternating layers of sand or pea gravel must be a maximum of five feet thick. The minimum thickness of the sealing ~~((material))~~ layers must be five feet. The remainder of the ~~((dug))~~ well shall be filled with unhydrated bentonite, neat cement, neat cement grout, or concrete to ~~((a maximum of))~~ within three feet ((below)) of land surface.

(4) Flowing artesian wells that are not leaking on the outside of the casing shall be decommissioned by pressure grouting with neat cement or weighted high solids bentonite slurry from the bottom of the well bore to land surface. If the well is leaking on the outside of the casing or if leaking develops while the decommissioning method above is employed, then the casing must be perforated and pressure grouted to replace all confining layers and to stop leakage.

(5) Placement of sealing material.

(a) Sealing material placed below the ~~((static))~~ water level shall be piped directly to the point of application or placed by means of a dump bailer or pumped through a tremie tube. As the sealing material is placed, the existing well tile may be encapsulated into the seal material. If concrete, neat cement grout, bentonite, bentonite slurry, or neat cement is used to seal below the static water level in the well, the material shall be placed from the bottom up by methods that avoid segregation or dilution of the material. When used to place concrete, neat cement, neat cement grout, or bentonite slurry the discharge end of the tremie tube shall be submerged in the sealing material to avoid breaking the seal while filling the annular space.

(b) All authorized sealing material placed above the static water level or into the dewatered portion of the well may be hand poured above the static water level, provided the material does not dilute or segregate, and result in a seal free of voids.

(c) When decommissioning wells that were originally constructed without casing, unhydrated bentonite chips or pellets may be hand placed, provided it forms a continuous seal.

WAC 173-160-410 What are the specific definitions for words in this chapter? This section specifically defines words associated with resource protection wells and geotechnical soil borings. To find the definitions of other words, see WAC 173-160-111.

(1) "Confining layer" or "confining formation" means a layer of low hydraulic conductivity material that significantly limits vertical movement of ground water.

(2) "Environmental investigation well" means a cased hole intended or used to extract a sample or samples of ground water, vapor, or soil from an underground formation and which is decommissioned immediately after the sample or samples are obtained. An environmental investigation well is typically installed using direct push technology or auger boring and uses the probe, stem, auger, or rod as casing. An environmental investigation well is not a geotechnical soil boring.

~~((+2+))~~ (3) "Geotechnical soil boring" or "boring" means ((an uncased)) a well drilled for the purpose of obtaining soil samples or information to ascertain structural properties of the subsurface.

~~((+3+))~~ (4) "Ground source heat pump boring" means a vertical boring constructed for the purpose of installing a closed loop heat exchange system for a ground source heat pump.

~~((+4+))~~ (5) "Grounding well" means a grounding electrode installed in the earth by the use of drilling equipment to prevent buildup of voltages that may result in undue hazards to persons or equipment. Examples are anode and cathode protection wells.

~~((+5+))~~ (6) "Instrumentation well" means a well in which pneumatic or electric geotechnical or hydrological instrumentation is permanently or periodically installed to measure or monitor subsurface strength and movement. Instrumentation well includes bore hole extensometers, slope indicators, pneumatic or electric pore pressure transducers, and load cells.

~~((+6+))~~ (7) "Monitoring well" means a well designed to obtain a representative ground water sample or designed to measure the water level elevations in either clean or contaminated water or soil.

~~((+7+))~~ (8) "Nested well" means the installation of more than one cased resource protection well in one bore hole. This does not preclude casing reductions or installation of vibrating wire piezometers.

~~((+8+))~~ (9) "Observation well" means a well designed to measure the depth to the water or water level elevation in either clean or contaminated water or soil.

~~((+9+))~~ (10) "Piezometer" means a well designed to measure water level elevation at a specific depth beneath the water table.

~~((+10+))~~ (11) "PTFE" means polytetrafluoroethylene casing materials such as teflon. The use of the term teflon is not an endorsement for any specific PTFE product.

(12) "Remediation well" means a well intended or used to withdraw ground water or inject water, air (for air sparging), or other solutions into the subsurface for the purpose of remediating, cleaning up, or controlling potential or actual ground water contamination.

~~((+11+))~~ (13) "Resource protection well" means a cased boring intended or used to collect subsurface information or to determine the existence or migration of pollutants within an underground formation. Resource protection wells include monitoring wells, observation wells, piezometers, spill response wells, remediation wells, environmental investigation wells, vapor extraction wells, ground source heat pump boring, grounding wells, and instrumentation wells.

~~((+12+))~~ (14) "Resource protection well contractor" means any person, firm, partnership, copartnership, corporation, association, or other entity, licensed and bonded under chapter 18.27 RCW, engaged in the business of constructing resource protection wells or geotechnical soil borings.

~~((+13+))~~ (15) "Resource protection report" or "geotechnical soil boring report" means a document that describes how a resource protection well or geotechnical soil boring was constructed or decommissioned and identifies its components per the requirements of WAC 173-160-420.

~~((+14+))~~ (16) "Spill response well" means a well used to capture or recover any spilled or leaked fluid which has the potential to, or has contaminated the ground water.

~~((+15+))~~ (17) "Structural properties" means subsurface engineering properties or geotechnical information used for the purpose of designing structures such as bridges, buildings, highways, pipelines, or for assessing slope stability samples.

~~((+16+))~~ (18) "Vapor extraction well" means a well used to withdraw gases or vapors from soil, rock, landfill, backfill or ground water for the purpose of investigating or remediating soil or ground water contamination or managing gases or vapors.

~~((+17+))~~ (19) "Vibrating wire piezometer" is a down hole instrument that measures water pore pressure and converts it to an electronic signal.

(20) "Well driller" or "driller" means a resource protection well contractor or operator and a water well contractor or operator.

~~((+18+))~~ (21) "Well" means water wells, resources protection wells, instrumentation wells, dewatering wells, and geotechnical soil borings. Well does not mean an excavation made for the purpose of obtaining or prospecting for oil or natural gas, geothermal resources, minerals, or products of mining, or quarrying, or for inserting media to repressure oil or natural gas bearing formations, or for storing petroleum, natural gas, or other products.

AMENDATORY SECTION (Amending Order 06-08, filed 11/21/06, effective 12/22/06)

WAC 173-160-420 What are the general construction requirements for resource protection wells? (1) No resource protection well or soil boring excavation may be used to withdraw or inject water for domestic, industrial, municipal, commercial, or agricultural purposes.

(2) No resource protection well or soil boring excavation may interconnect aquifers.

(3) Nested resource protection wells are prohibited.

(4) Cuttings, development water, and other investigation derived waste from resource protection well construction or geotechnical soil borings shall be managed in a manner consistent with the intent and purposes of the Water Pollution Control Act, chapter 90.48 RCW, the Hazardous Waste Management Act, chapter 70.105 RCW, and implementing regulations.

(5) Well tagging:

(a) It shall be the driller's responsibility to place a well identification tag with a unique identification number on every resource protection well that they construct or alter within thirty days of completion of the well. Uncased geotechnical soil borings and environmental investigation wells are exempt from the tagging requirements of this chapter.

(i) The alpha-numeric number shall be recorded on the drilling report in the space provided.

(ii) The driller shall remove the well identification tag on all resource protection wells they decommission and shall attach the tag to the decommissioning well report.

(b) It shall be the well owner's responsibility to place a well identification tag with a unique identification number on every resource protection well they own and which was completed prior to the effective date of this regulation.

(i) Upon request, the department shall furnish the well owner with a well tag and tagging instructions.

(ii) The well owner shall tag their well(s) and submit a completed tagging report to the department.

(c) The well tag shall be permanently attached to:

(i) The ((outer)) well casing and be visible above land surface for all wells which have been completed above land surface. ((For wells completed below land surface, the well tag shall be attached to))

(ii) The well casing or to any permanent and protected portion of the vault for wells completed below land surface.

(iii) A prominent system component visible above land surface for ground source heat pump borings.

(d) All well identification tags shall be supplied by the department.

(e) It is unlawful for a person to tamper with or remove a well identification tag except during well alteration.

(6) All resource protection wells will be sealed in accordance with WAC 173-160-450 regardless of the method of installation.

Except, resource protection wells that are properly decommissioned prior to the removal of any drilling equipment from the well location are exempted from the surface sealing requirements of this chapter. Provided the decommissioning process includes the removal of any conduit, tubing, probe, or other items inserted into the ground.

(7) All geotechnical soil borings shall be decommissioned under the terms of this chapter.

(8) Except as provided in RCW 18.104.180, all construction, alteration, reconstruction, and decommissioning of resource protection wells and geotechnical soil borings shall be done by an individual licensed under the provisions of chapter 173-162 WAC.

(9) A notice of intent to construct or decommission a resource protection well and a geotechnical soil boring shall be filed with the department a minimum of seventy-two hours prior to initiating construction or decommissioning of the well(s) or boring(s). A fee must accompany each notice of intent to construct or decommission a resource protection well.

(a) The fee for a resource protection well, except for an environmental investigation well, a ground source heat pump boring, or a grounding well, is forty dollars for each well.

(b) The fee for an environmental investigation well in which ground water is sampled or measured is forty dollars for the construction of up to four environmental investigation wells per project, and ten dollars for each additional environmental investigation well constructed on a project with more than four wells. There is no fee for soil or vapor sampling purposes.

(c) The fee for a ground source heat pump boring or a grounding well is forty dollars for construction of up to four ground source heat pump borings or grounding wells per project and ten dollars for each additional ground source heat pump boring or grounding well constructed on a project with more than four wells.

(d) The fee to decommission a resource protection well, except for an environmental investigation well, is twenty dollars per well. There is no fee to decommission an environmental investigation well or a geotechnical soil boring.

(e) The fee to decommission a ground source heat pump boring or a grounding well is twenty dollars per well.

(f) Under some circumstances, it may be necessary to construct more resource protection wells or geotechnical soil borings than originally anticipated. When additional resource protection wells are constructed on a site for which a notice of intent and fee were submitted, a second notice and fee shall be submitted within twenty-four hours after all wells have been completed or as soon as the final number of wells to be constructed is determined, whichever is sooner. When additional geotechnical soil borings are needed, the borings may be completed. A follow-up notice of intent shall be submitted to the department within twenty-four hours after all borings are constructed. Notification to construct multiple wells or geotechnical soil borings within the same quarter/quarter section, township, and range may be submitted on one notice form.

(10) Resource protection well (~~and geotechnical soil boring~~)

drilling)) reports.

(a) ~~((Every well contractor))~~ Anyone who constructs or decommissions a well is required to submit a complete well report on the construction(~~(, alteration,)~~) or decommissioning of all resource protection wells and geotechnical soil borings (~~(they construct)~~). Reports must be submitted to the water resources program within thirty days after completion of construction(~~(, alteration,)~~) or decommissioning. Submission of a well report to consulting firms does not meet the (~~(well contractor's obligation)~~) requirement of this section. The report must be an accurate summation of data collected in the field taken from field notes written as the well was constructed or decommissioned. Field notes must be available at all times during construction or decommissioning for review by state and local inspectors and kept until the well report is submitted.

(b) ~~((This applies to all resource protection wells and geotechnical soil borings.~~

~~(c))~~ The resource protection well ~~((and geotechnical soil boring))~~ report must be made on a form provided by the department, or a reasonable facsimile of the form, as approved by the department.

~~((d))~~ (c) Where applicable the report shall include the following information:

(i) Owner's name; operator/trainee name; operator/trainee license number; contractor registration number, drilling company name;

(ii) Tax parcel number;

(iii) Well location address;

(iv) Location of the well to at least 1/4, 1/4 section or smallest legal subdivision;

(v) Unique well identification tag number;

(vi) Construction date;

(vii) Start notification number;

(viii) Intended use of well;

(ix) The well depth, diameter, and general specifications of each well;

(x) Total depth of casing;

(xi) Well head elevation;

(xii) Drilling method;

(xiii) Seal material, seal location and type of placement used;

(xiv) Filter pack location; filter pack material used;

(xv) The thickness and character of each bed, stratum or formation penetrated by each well including identification of each water bearing zone;

(xvi) Casing gauge, diameter, stickup, type of material, and length, also of each screened interval or perforated zone in the casing;

(xvii) The depth to the static water level, as measured below the land surface; and

(xviii) Such additional factual information as may be required by the department.

~~((e))~~ (d) The well report must ~~((show the license number and signature of the person who constructed the well. If this is an unlicensed person, exempted under RCW 18.104.180(2), the report shall show the license number and signature of the licensed individual who witnessed the drilling. Resource protection well reports for wells constructed by trainees shall have the signature and license number of the trainee and licensed operator))~~ include one of the following:

(i) The license number and signature of the person who constructed or decommissioned the well;

(ii) The license number and signature of the trainee and the licensed operator under chapter 18.104 RCW; or

(iii) The license number and signature of an exempted individual as defined under RCW 18.104.180(3).

(e) This rule shall allow an individual to submit electronic reports in accordance with department procedures. The use of a digital signature in the electronic reports will be authorized as a substitute for an original signature under (d) of this subsection.

What are the surface protection requirements?

(11) All resource protection wells shall be capped and protected using one of the following methods:

(a) If the well is cased with metal and completed above the ground surface, you must attach a watertight cap with a lock to the top of the casing.

(b) If the well is not cased with metal and completed above the land surface, you must install a protective metal casing over and around the well. The protective casing shall extend at least six inches above the top of the well casing and be cemented at least two feet into the ground. A cap with lock shall be attached to the top of the protective casing.

(12) You shall protect the well(s) completed above ground from damage by:

(a) Cementing three metal posts, at least three inches in diameter, in a triangular array around the casing and at least two feet from it. Each post shall extend at least three feet above and below the land surface.

(b) A reinforced concrete pad may be installed to protect against and prevent frost heave. If installed, the concrete pad shall extend to a depth equal to anticipated frost depth. When a concrete pad is used, the well seal may be part of the concrete pad.

(13) If the well is completed below land surface, a watertight cap with a lock shall be attached to the top of the well casing. A metal monument or equivalent shall be installed over and around the well. The monument shall serve as a protective cover and be installed level with the land surface and be equipped with a waterproof seal to prevent the inflow of any water or contaminants. Drains will be provided, when feasible, to keep water out of the well and below the well cap. The cover must be designed to withstand the maximum expected loading.

(14) The protective measures may be waived or modified upon

written approval from the department (a variance).

(15) If the well is damaged, the well protection measures and casing shall be repaired to meet the requirements of this chapter. If the well is damaged beyond repair, it shall be decommissioned in accordance with WAC 173-160-460.

AMENDATORY SECTION (Amending Order 06-08, filed 11/21/06, effective 12/22/06)

WAC 173-160-430 What are the minimum casing standards? (1) The casing may not ~~((effect))~~ affect or interfere with the chemical, physical, radiological, or biological constituents of interest. The casing shall be resistant to the corrosive effects of the surrounding formations, earth, and water and shall be impervious to any contaminants encountered.

(2) The casing shall ~~((also))~~ withstand ~~((normal))~~ typical forces which act upon it during and after installation. All resource protection well casing shall conform to ASTM Standards, or at least 304 or 316 stainless steel, PTFE, or Schedule 40 PVC casing.

NEW SECTION

WAC 173-160-442 What are the limitations for use of drilling materials? (1) At no time shall a product contain materials that:

- (a) Are toxic or polluting;
- (b) Develop odor or color changes in the water; or
- (c) Serve as a microbial nutrient.

(2) Organic materials which foster or promote undesired organic growth or have the potential to degrade water quality shall not be employed in the construction of a resource protection well. This includes, but is not limited to, brans, hulls, grains, starches, and proteins, unless NSF/ANSI approved.

NEW SECTION

WAC 173-160-444 What are the standards for use of polymers and additives? (1) All polymers and additives used in any well shall be certified by NSF/ANSI approval standards for use in potable water supply wells, or equivalent standards as approved by

the department. The product shall be clearly labeled as meeting these standards.

(2) Polymers and additives must be designed and manufactured to meet industry standards to be nondegrading and must not act as a medium which will promote growth of microorganisms.

AMENDATORY SECTION (Amending Order 06-08, filed 11/21/06, effective 12/22/06)

WAC 173-160-450 What are the well sealing requirements? (1) All resource protection wells constructed shall have a continuous seal, which seals the annular space between the bore hole and the permanent casing. The seal shall be constructed to prevent interconnection of separate aquifers penetrated by the well, and shall provide casing stability. Except for environmental investigation wells, the seal shall have a minimum diameter of four inches larger than the nominal size of the permanent casing, and shall extend from land surface to the top of the filter pack. The filter pack shall be no less than one foot or greater than five feet above the screen interval. See Figure 7. Wells that are installed using direct push technology will follow the sealing guidelines of WAC 173-160-451.

(2) After the permanent casing has been set in final position, the filter pack (optional) and sealing material shall be placed in the open bore hole annular space that must be a minimum of four inches greater in diameter than the nominal size of the permanent casing. After installing the filter pack (optional) a layer of bentonite shall be placed on top of the filter pack to maintain separation between the seal material and the screened interval. Insure that placement will not disturb the filter pack. The remaining annular space shall be filled to land surface in a continuous operation with bentonite, neat cement, or neat cement grout. If ((a)) neat cement((/)), neat cement grout or bentonite slurry is used as the sealant, it shall be installed with a tremie tube and pumped from the top of the bentonite plug (above the filter pack) to land surface. Use only potable water to hydrate the mixture.

(3) The completed annular ((space)) seal shall fully surround the permanent casing, be evenly distributed, free of voids, and extend from the permanent casing to undisturbed or recompacted soil.

(4) All sealing materials used shall conform to one of the following minimum requirements:

(a) **Bentonite sealants:**

(i) Bentonite used to prepare slurries for sealing((7)) or decommissioning shall be specifically designed for this purpose. ~~((At no time shall grout slurry contain materials that are toxic, polluting, develop odor or color changes, or serve as a micro-~~

~~bacterial nutrient.))~~ All bentonite slurries shall be prepared and installed according to the manufacturer's instructions. ~~((All additives must be certified by a recognized certification authority such as NSF.))~~ Active solids content (bentonite) shall be twenty percent by weight or greater in all bentonite slurries. The active solids shall be checked by using the following formula:

$$\frac{\text{Weight of bentonite (lbs.)}}{\text{Weight of bentonite (lbs.)} + (\text{gallons of water} \times 8.33 \frac{\text{lbs.}}{\text{gal.}})} \times 100 = \% \text{ solids}$$

Example:

$$\frac{50 \text{ lbs. of bentonite}}{50 \text{ lbs. of bentonite} + (24 \text{ gallons of water} \times 8.33 \frac{\text{lbs.}}{\text{gal.}})} \times 100 = 20\% \text{ solids}$$

(ii) Unhydrated bentonite--pelletized, granulated, powder, or chip bentonite may be used in the construction of seals or in decommissioning of ~~((resource protection))~~ wells. The bentonite material shall be specifically designed for sealing or decommissioning and be within the industry tolerances for dry western sodium bentonite. ~~((Polymer additives must be designed and manufactured to meet industry standards to be nondegrading and must not act as a medium which will support or promote the growth of micro-organisms. All unhydrated bentonite used for sealing or decommissioning must be free of organic polymers.))~~ Placement of bentonite shall conform to the manufacturer's specifications and result in a seal free of voids or bridges.

(iii) All bentonite used in any well shall be certified by NSF/ANSI approval standards for use in potable water supply wells, or equivalent standards as approved by the department. The product shall be clearly labeled as meeting these standards.

(b) Cement sealants:

(i) Neat cement consists of either portland cement types I, II, III, or high-alumina cement mixed with not more than six gallons of potable water per sack of cement (ninety-four pounds per sack).

(ii) Neat cement grout consists of neat cement with up to five percent bentonite clay added, by dry weight of the bentonite. Bentonite is to be added to improve flow qualities and compensate for shrinkage.

~~((Concrete sealants consist of clean, hard and durable aggregate with not less than five sacks (ninety-four pounds per sack) of portland cement per cubic yard of concrete sealant and water.))~~

~~(A) The maximum diameter of aggregate particles may not exceed 1 1/2 inches, but in any case may not exceed 1/5 the minimum width of the casing thickness.~~

~~(B) The ratio of coarse aggregate to fine aggregate (passing No. 4 U.S. Standard Sieve) must be approximately 1 1/2 to 1 by volume, but in any case, may not exceed 2 to 1 nor be less than 1 to 2.~~

~~(iv))~~ Expanding agents, such as aluminum powder, may be used at a rate not exceeding 0.075 ounce (1 level teaspoon) per sack (ninety-four pounds per sack) of dry cement. The powder may not contain polishing agents. High-alumina cement and portland cement of any type must not be mixed together.

(5) This section may not preclude the use of new sealant materials which have been approved by the technical advisory group.

AMENDATORY SECTION (Amending Order 06-08, filed 11/21/06, effective 12/22/06)

WAC 173-160-453 What are the minimum standards for construction of ground source heat pump borings? (1) General requirements.

(a) Applicability of minimum standards. The minimum standards set forth herein apply to all ground source heat pump borings as defined in WAC 173-160-111(~~(, constructed by a licensed operator)~~).

(b) Prohibition against other uses. Ground source heat pump borings cannot be used for any purpose other than heat exchange. After completion, ground source heat pump borings shall not be converted to any other type of well except by written approval by the department. The operator shall ensure that the ground source heat pump boring is constructed according to this chapter.

(2) Location of ground source heat pump borings.

(a) A ground source heat pump boring shall not be located within one hundred feet from any water supply well.

(b) The setback from public water supply wells for ground source heat pump borings must comply with applicable department of health sanitary control zone regulations for the public water supply wells. Where the sanitary control zone is greater than one hundred feet the setback should reflect the expanded distance.

(c) Variances to the standard setback for water supply wells can be obtained when:

(i) The approved sanitary control zone for the public supply well is less than one hundred feet. Notification and concurrence is required from the department of health to insure that the new setback is consistent with the approved public water supply well sanitary control zone. Variances for public supply wells will be issued by the local or state health authority.

(ii) The water supply well is not a public water supply well and the reduced set back is adequate to protect against

encroachment on the well and can provide adequate protection against potential contamination. The reduced set back shall be no ~~((more))~~ less than seventy-five feet.

(d) No variance shall be approved for a setback less than the approved sanitary control zone for a water supply well, unless it can be demonstrated that the water supply well is hydrogeologically protected from any potential threat posed by the closed-loop heat system.

(3) Construction standards for ground source heat pump borings. Site specific conditions shall be assessed to determine the best method and materials to be used for sealing the well annulus to protect the ground water.

(a) Casing material. If permanent casing is needed in a ground source heat pump boring, it must meet standards set out in WAC 173-160-201 for steel and for plastic.

(b) In a closed-loop ground source heat pump boring, the material used to make up the heat exchange loop that is placed into the ground must be able to withstand the ~~((normal))~~ typical forces which act upon it during and after construction. It shall be resistant to the corrosive effects of the surrounding formations, earth, water, and heat exchange fluids within the pipe.

(c) Pressure testing. Pressure testing will be done in accordance with manufacturer recommended specifications. The closed-loop assembly pipe within the bore hole shall not leak or cause contamination to the ground water.

(d) All fluids used in the construction and testing of ground source heat pump borings will be handled and utilized in a manner that does not contaminate the ground water or surface water ~~((s of the state))~~.

(e) Bore hole size. The hole size for ground source heat pump borings must be of sufficient size to allow placement of the heat exchange loop and ~~((, tremie pipe, but in no case shall the bore hole diameter be less than six inches when one inch loop pipe is installed. When a loop pipe greater than one inch is utilized, the size of the bore hole will be determined by ecology))~~ tremie tube to the bottom of the hole.

(f) No more than one heat exchange loop can be placed in one bore hole.

(g) Grouting of an uncased bore hole. Grouting (sealing) the bore hole of a ground source heat pump boring must be completed immediately after the heat exchange loop is installed to avoid cave in of the uncased hole. The near surface area where the ground source heat pump borings will be connected to a manifold to connect it to the closed-loop system may be filled with earth materials.

(i) Sealing must be done with an active solids content bentonite grout slurry (minimum twenty percent active solids by weight) per WAC 173-160-221. Use of controlled density fill (CDF) and fly ash is prohibited.

(ii) Sealing material placed in the bore hole shall be uncontaminated; drilling fluids must be purged from the bore hole during the installation of the sealing material. Neither cuttings from the drilling process nor drilling fluid shall be used as bore

hole sealing material.

(iii) ~~((Slurry))~~ Mixes of bentonite ~~((grout))~~ slurry shall be installed by pumping through a tremie ~~((pipe))~~ tube in a continuous operation using a positive displacement method. Polymer additives designed to retard swelling are acceptable for use with the bentonite ~~((grout))~~ slurry per WAC ~~((173-160-221 (1)(a)))~~ 173-160-450. The tremie ~~((pipe))~~ tube will extend to the full depth of the bore hole before pumping begins. Minimum slurry volume used must be equal to or exceed the calculated annulus volume of the bore hole. Grouting material shall surround all pipes remaining in the bore hole to land surface.

~~((g))~~ (h) Grouting of a permanently cased bore hole~~((Grouting of cased bore holes))~~ shall be sealed in accordance with this chapter. Exception: When the casing is perforated from bottom to land surface and is pressure grouted in accordance with WAC 173-160-381 (1)(a).

~~((h))~~ (i) Unsuccessful installation of a ground source heat pump boring. If grouting is not successful, the department must preapprove an alternate completion of the ground source heat pump boring. If an alternate completion is not approved, the well must be properly decommissioned.

~~((i))~~ (j) An open-loop system must meet the construction standards of a water well. If the withdrawal of ground water exceeds the exemption requirements of RCW 90.44.050, a water right permit is required.

~~((j))~~ (k) It shall be the responsibility of the driller to properly construct the bore hole, pressure test the loop pipe, install the loop pipe, and grout the bore hole.

AMENDATORY SECTION (Amending Order 06-08, filed 11/21/06, effective 12/22/06)

WAC 173-160-456 What are the minimum standards for construction of grounding wells? (1) ~~((General requirements:))~~ Grounding wells (cathodic protection wells or anode wells) ~~((These wells))~~ must be constructed in accordance with the provisions of Part One--General Requirements for Water Well Construction, chapter 173-160 WAC.

(2) Grounding wells shall be designed by an engineer, licensed in Washington state, trained in the design of corrosion protection wells.

(3) The internal materials used and size of element installed shall meet all industry standards for cathodic protection and anode wells.

(4) Grounding wells shall not pollute the waters of the state.

(5) If constructed within one hundred feet of a potential source of contamination, sealing is required to a minimum depth of fifty feet or the first significant confining layer, whichever is

deeper, in accordance with WAC 173-160-241.

(6) Where the well construction regulations cannot be met, a variance may be requested.

(7) Grounding wells twenty-five feet in depth or less are exempt from all notice, licensing, fees, and reporting requirements of these regulations, however, commingling of aquifers is still prohibited.

(8) Driven grounding rods installed to a depth of twenty-five feet or less are exempt from all notice, licensing, fees, and reporting requirements of these regulations.

NEW SECTION

WAC 173-160-457 How are vibrating wire piezometers constructed? (1) The bore hole containing the vibrating wire piezometers shall have a minimum diameter at least four inches larger than the diameter of the instrument.

(2) When sealing with a grout or slurry, the bore hole shall be grouted from the bottom up via a tremie tube. The tremie tube may be left within the bore hole provided: It meets casing standards, is filled completely with grout and the annular requirements of this section are met.

(3) UngROUTED tubing, piping, liner, or casings shall not be left in the bore hole upon completion.

(4) Individual transducers may be sand packed provided that the sand pack is not more than five feet in thickness.

(5) Sealing between sand packed transducers shall be designed and constructed to prohibit flow between monitored zones. At no time shall a vibrating wire piezometer bore hole connect aquifers.

NEW SECTION

WAC 173-160-458 What sealing materials are allowed for sealing vibrating wire piezometers? (1) Vibrating wire piezometers shall be sealed using materials as allowed in WAC 173-160-450; or sealing materials as designed and recommended by the manufacturer provided that the material, when placed, provides a permeability of 1×10^{-7} cm/sec or less. The licensed driller or engineer shall provide documentation from the manufacturer demonstrating that the sealing material meets the permeability requirements of this section.

(2) The use of bentonite products intended for use as drilling fluids, low solids content bentonite mixtures, fly ash, and hydrated lime are prohibited as additives or sealants.

AMENDATORY SECTION (Amending Order 06-08, filed 11/21/06, effective 12/22/06)

WAC 173-160-460 What is the decommissioning process for resource protection wells? (1) For resource protection wells and ((geotech)) geotechnical soil borings that were not constructed in accordance with these regulations, or for which a drilling report required under this section is missing, ((shall be decommissioned)) remove all debris, accumulated sediment, equipment and obstructions from the well casing, except well screens and packers, and decommission in one of the following ways:

(a) Perforate the casing from the bottom to land surface and pressure grout the casing.

(i) Perforations shall be at least four equidistant cuts per row, and one row per foot. Each cut shall be at least one and one-half inches long.

(ii) Apply enough pressure to force the sealing material through the perforations, filling any voids on the outside of the casing.

(iii) The remainder of the casing shall be filled with neat cement grout, neat cement, or bentonite slurry; or

(b) Withdraw the casing and fill the bore hole with neat cement grout, neat cement, bentonite or bentonite slurry as the casing is being withdrawn.

(2) For resource protection wells and geotechnical soil borings that were constructed in accordance with these regulations, remove all debris, accumulated sediment, equipment and obstructions from the well casing, except well screens and packers and then decommission in one of the following ways:

(a) Wells with an inside casing diameter equal to or greater than one inch and constructed in accordance with these regulations as verified through a field examination and review of the drilling report shall be decommissioned by filling the casing from bottom to land surface with bentonite, bentonite slurry, neat cement grout, or neat cement.

((+3)) (b) Wells with an inside casing diameter less than one inch shall be decommissioned by pressure grouting the entire casing length with bentonite slurry, neat cement grout, or neat cement.

((+4)) (c) Vibrating wire piezometers installed ((per)) to meet or exceed the sealing requirements of WAC 173-160-450, 173-160-457, and 173-160-458 are exempt from ((these)) the decommissioning procedures and decommissioning reporting requirements provided here.

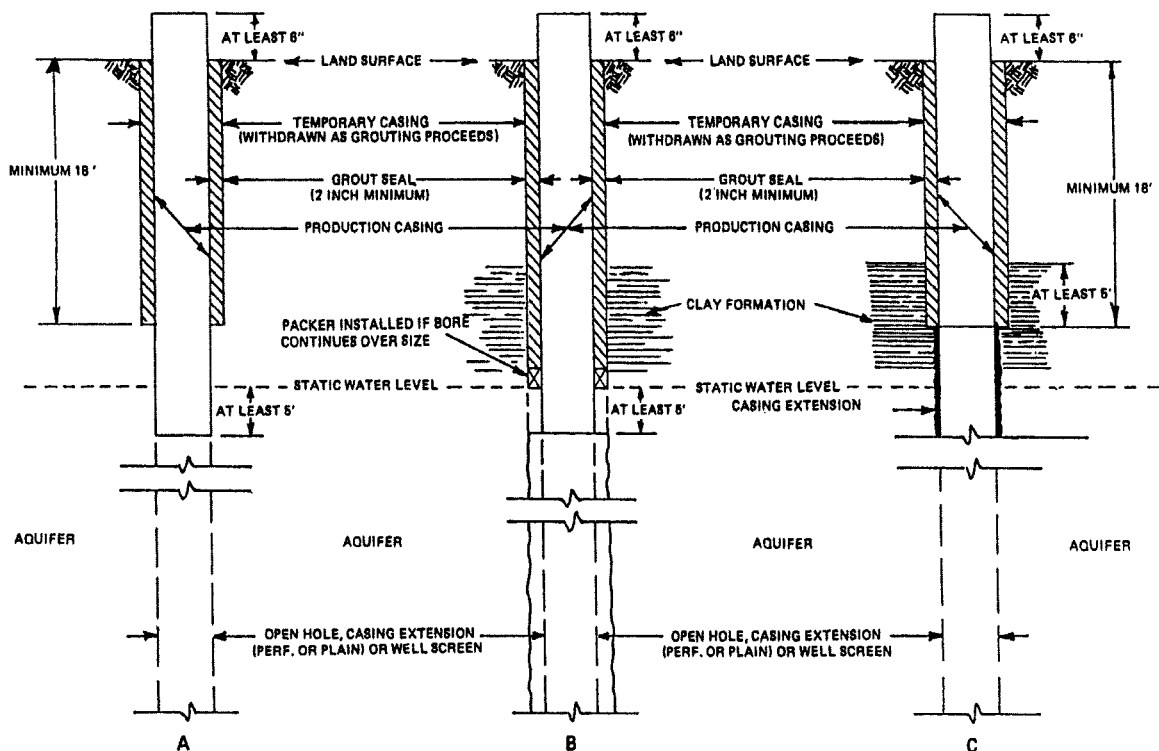
((+5)) (d) Direct push wells shall be decommissioned in accordance with this section.

((+6)) (e) Geotechnical soil borings, or boring, shall be decommissioned by sealing from bottom to land surface with

bentonite, bentonite slurry, neat cement grout, or neat cement. Sealing material placed below the static water level shall be piped directly to the point of application or placed by means of a dump bailer or pumped through a tremie tube. If ~~((cement))~~ bentonite slurry, neat cement grout~~((7))~~ or neat cement is used to seal below the ~~((static))~~ water level in the well, the material shall be placed from the bottom up by methods that avoid segregation or dilution of the material. When used to place bentonite slurry, neat cement or neat cement grout, the discharge end of the tremie tube shall be submerged in the bentonite slurry, neat cement or neat cement grout to avoid breaking the seal while filling the annular space. Provided the material does not dilute or segregate and the resulting seal is free of voids, sealing material may be hand poured above the static water level.

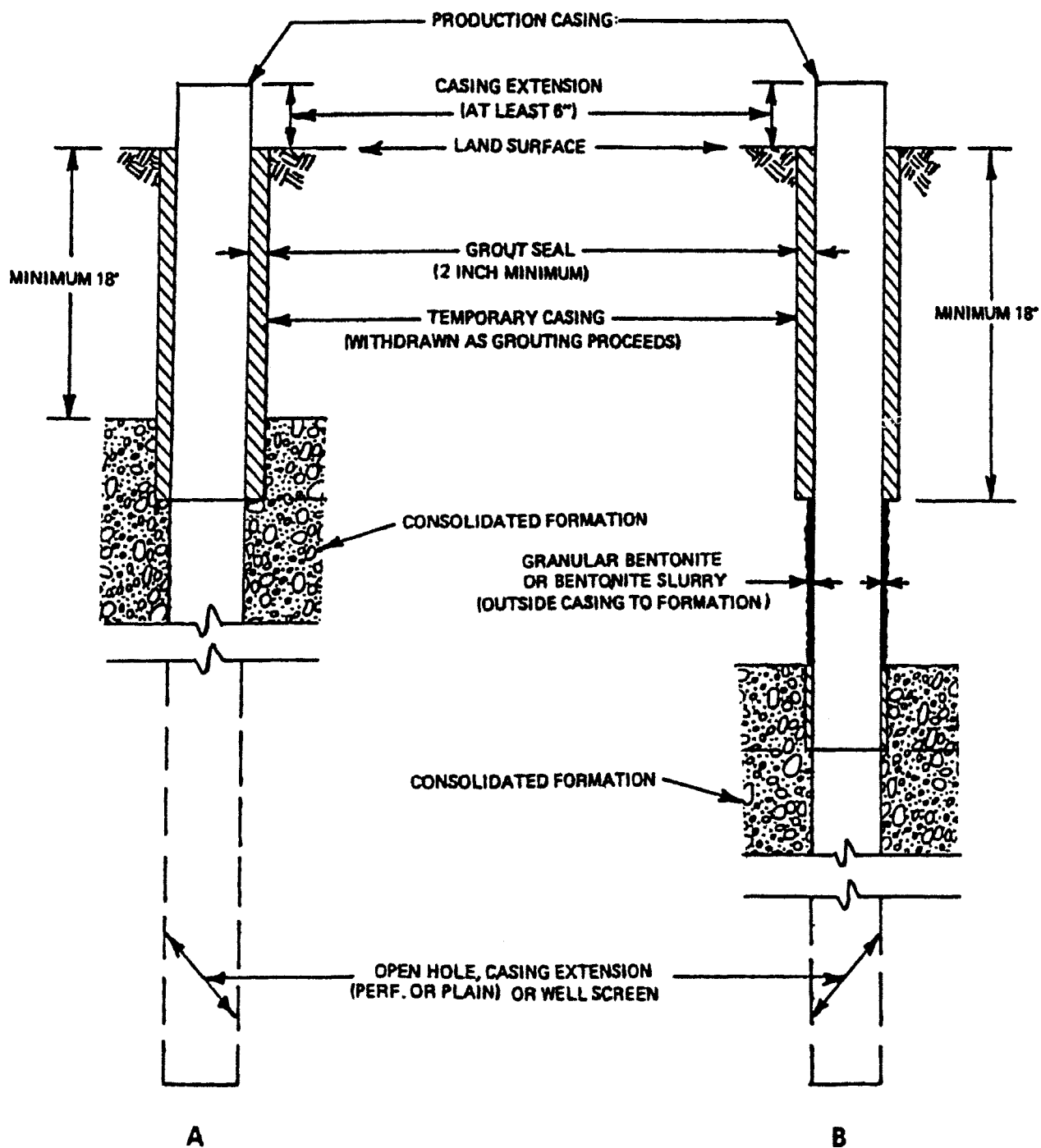
AMENDATORY SECTION (Amending Order 98-17, filed 9/2/98, effective 10/3/98)

WAC 173-160-990 Well construction illustrations.



NOT TO SCALE

Figure 1. SEALING OF UNCONSOLIDATED FORMATIONS



NOT TO SCALE

Figure 2. SEALING OF CONSOLIDATED FORMATIONS

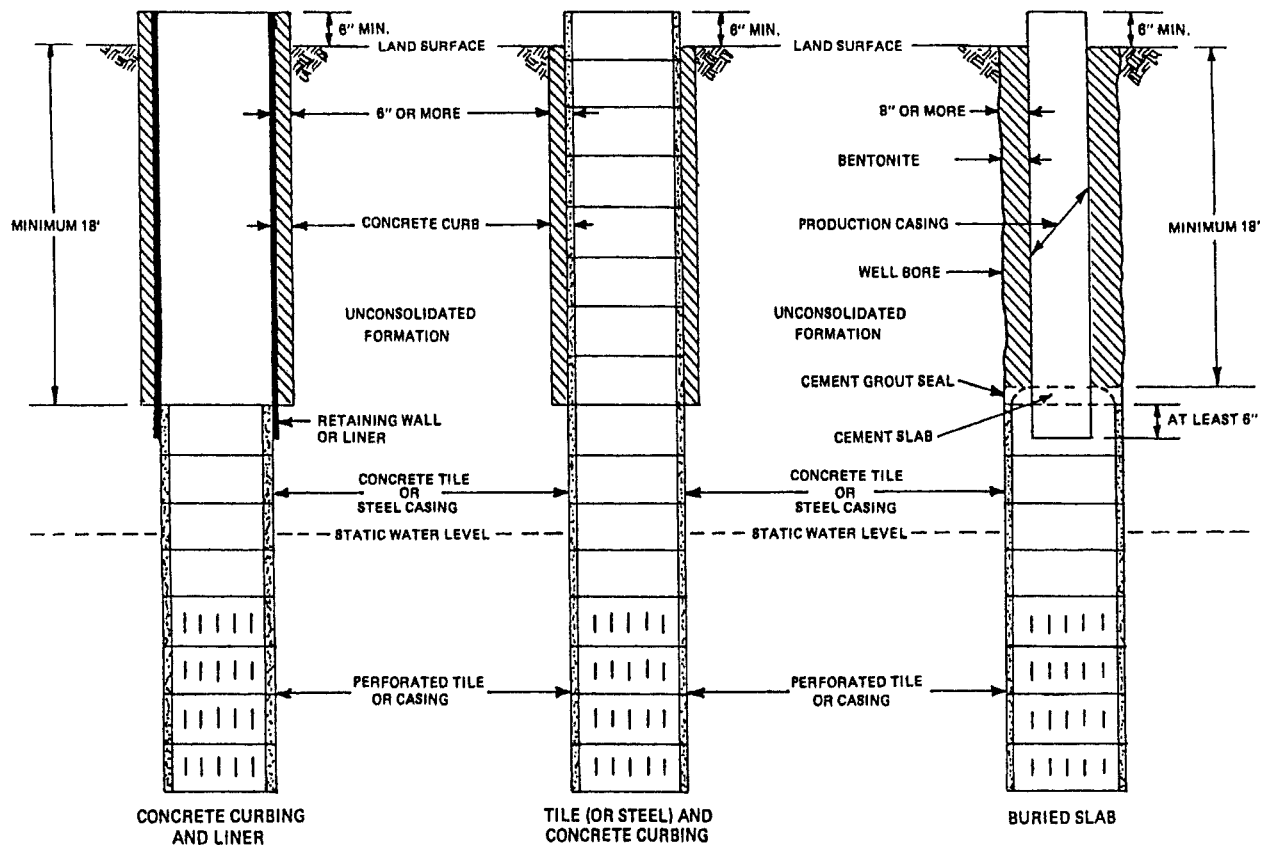
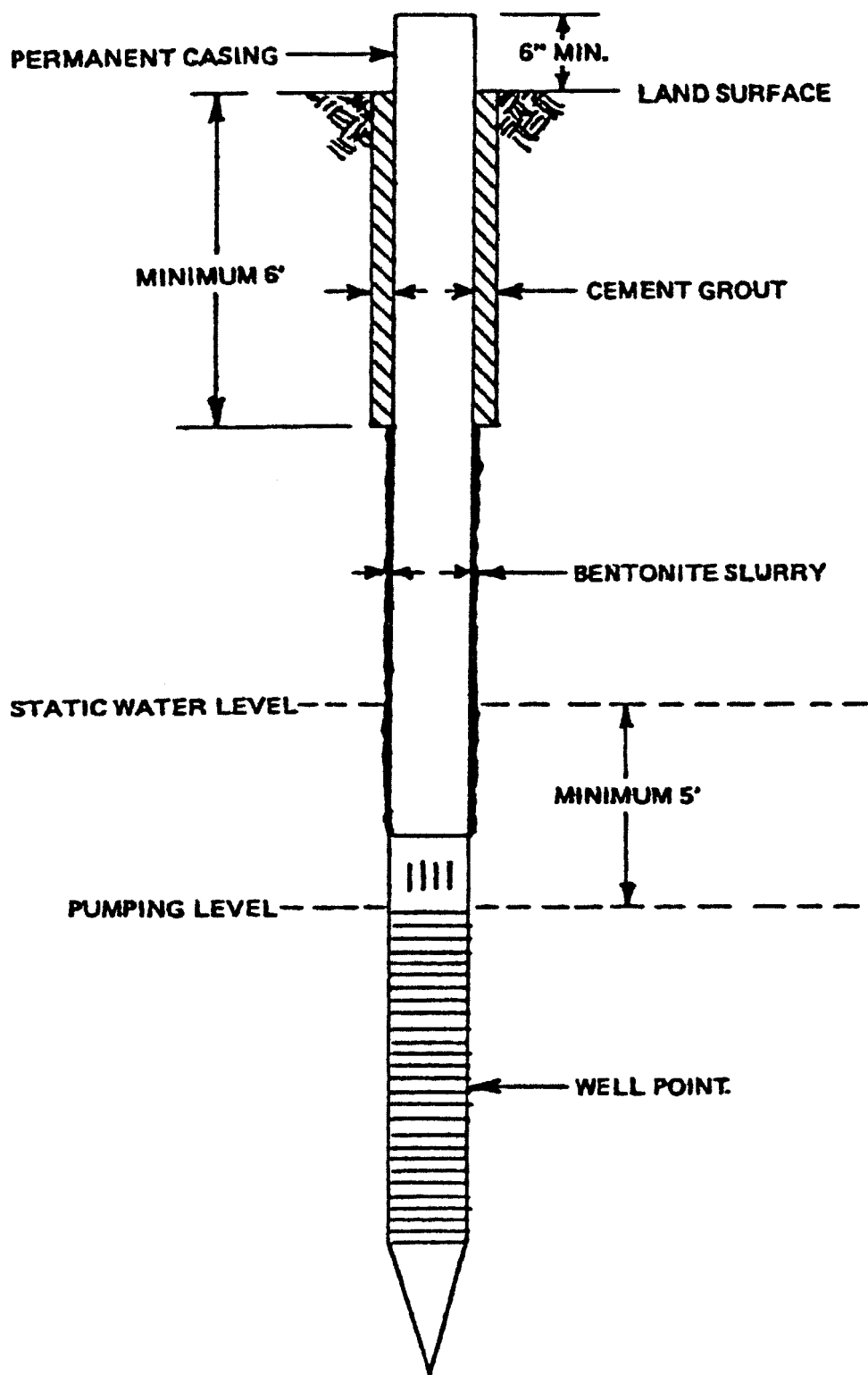


Figure 3. SEALING OF DUG WELLS



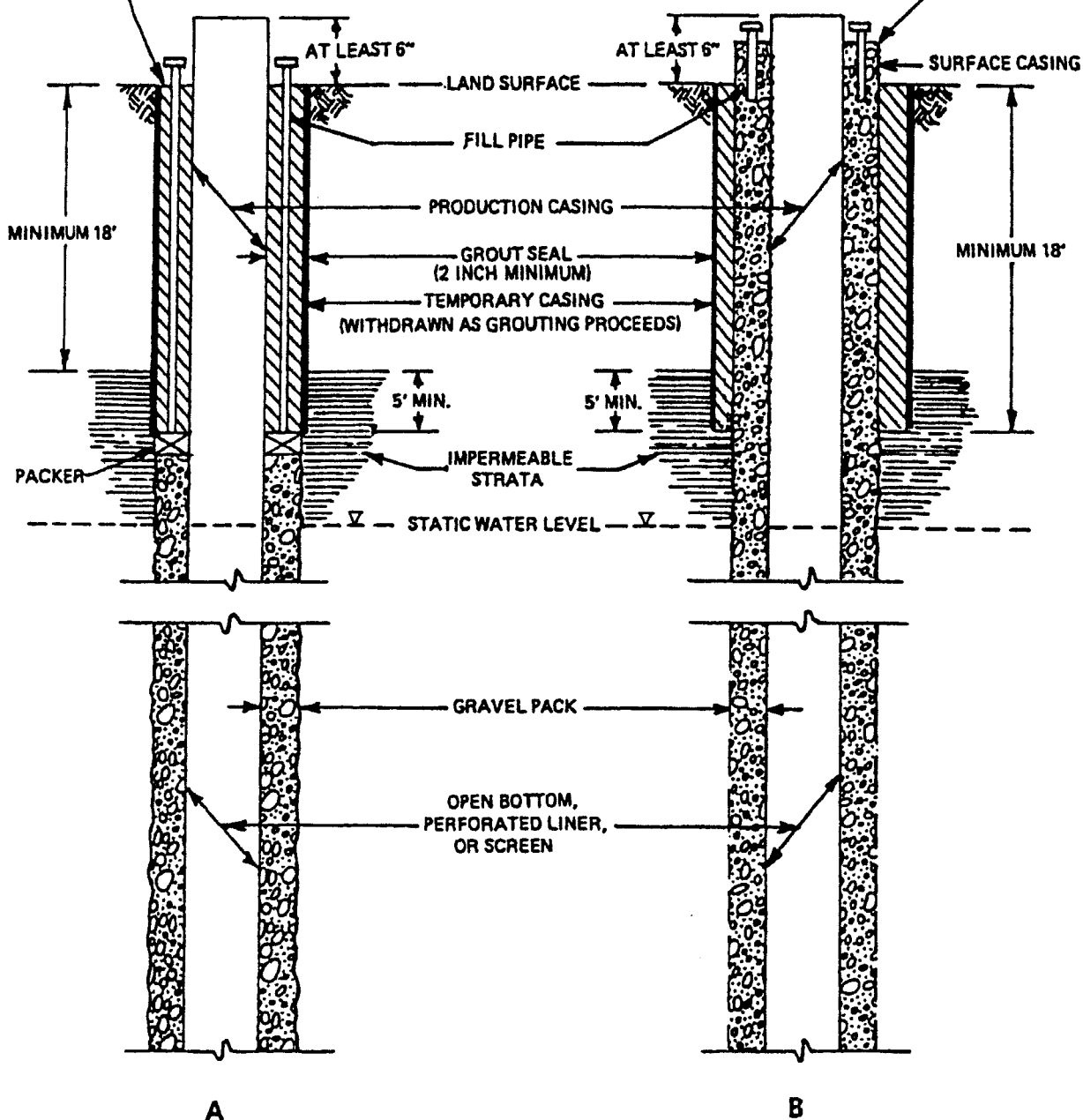
NOT TO SCALE

Figure 4. SEALING OF DRIVEN AND JETTED WELLS

((STRICKEN GRAPHIC

WATER TIGHT SEAL BETWEEN
CASING, OVER SIZE BORE HOLE
AND FILL PIPE

WATER TIGHT SEAL BETWEEN
CASINGS AND DRILL PIPE



STRICKEN GRAPHIC))

((NOT TO SCALE

A--WELL CONSTRUCTED WITH TEMPORARY SURFACE CASING.

B--WELL CONSTRUCTED WITH PERMANENT SURFACE CASING.

Figure 5. SEALING OF GRAVEL--PACKED WELLS))

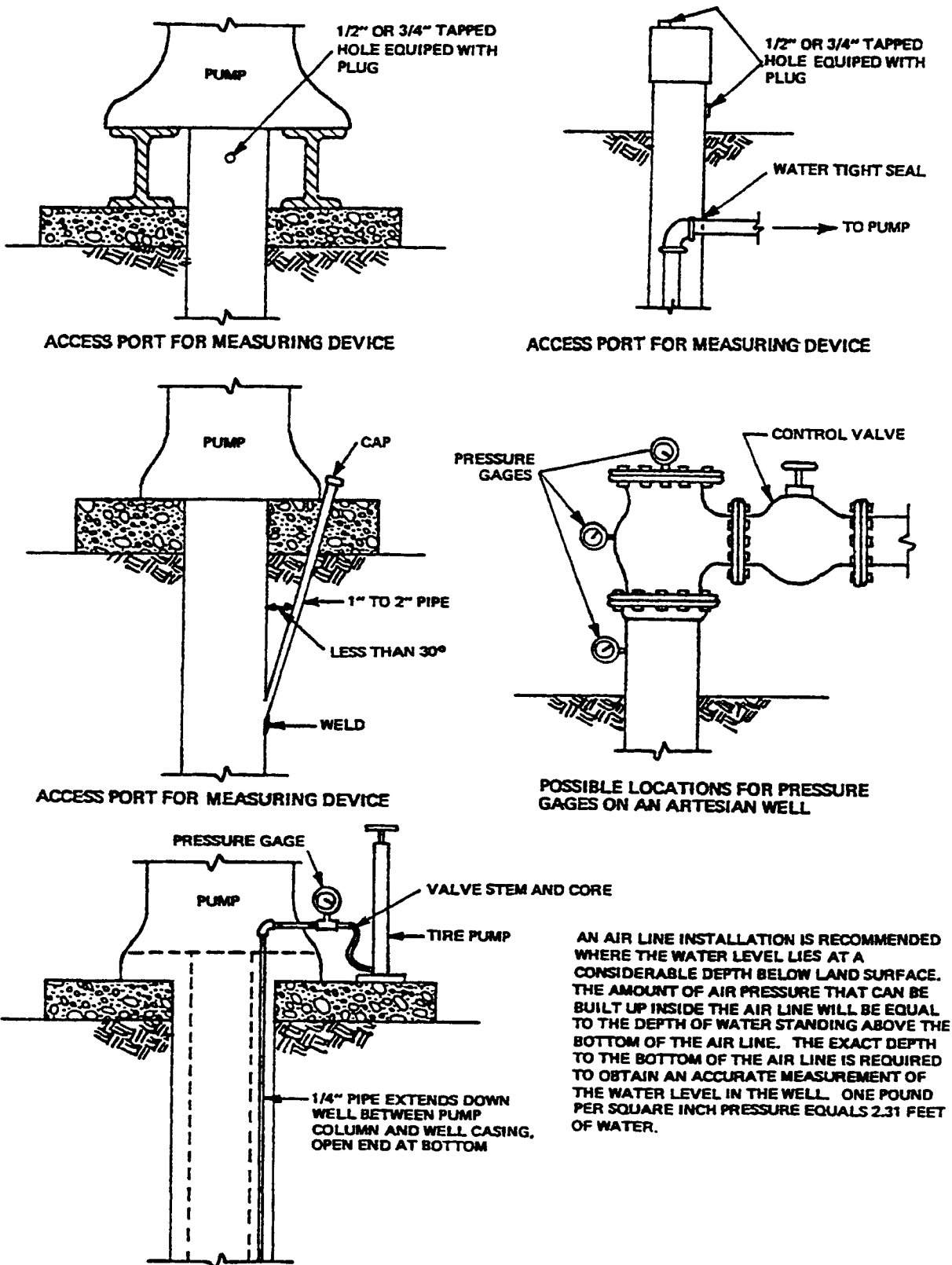


Figure ((6:)) 5. SUGGESTED METHODS FOR INSTALLING PRESSURE GAGES AND AIR LINES FOR MEASURING WATER LEVELS IN WELLS

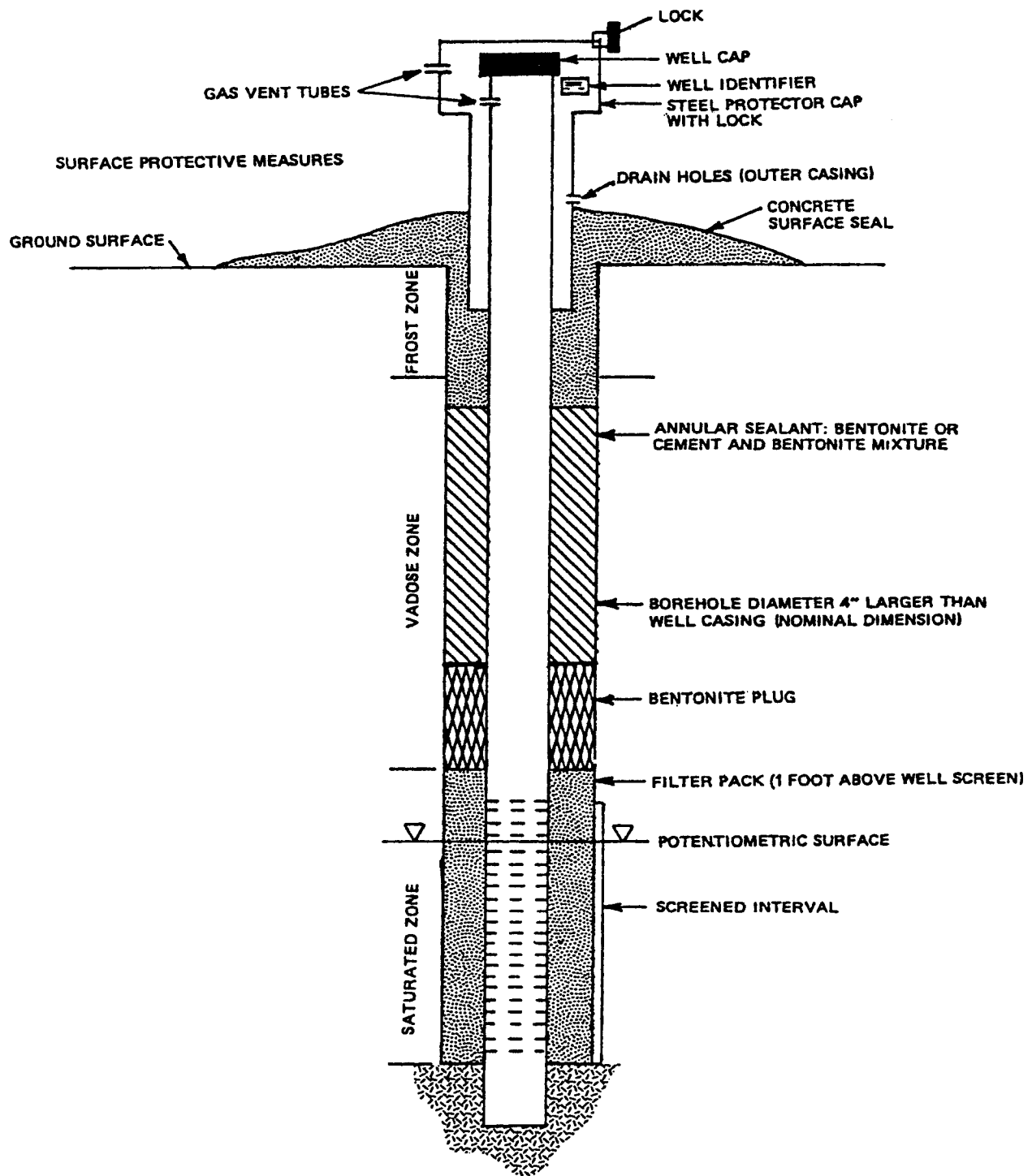


Figure ((7-)) 6. GENERAL RESOURCE PROTECTION WELL--CROSS SECTION.